PUBLICATION OFFICES

168-177 POTTER BUILDING, NEW YORK.

Telephone Call: Murray 586. Cable Address: "Electrical," New York.

W. J. JOHNSTON, Editor and Publisher.

T. COMMERFORD MARTIN, JOSEPH WETZLER, } Associate Editors.
G. H. STOCKBRIDGE, Assoc. Editor Patent Department.
CLARENCE E. STUMP, Business Manager.
WALTER T. HUNT, Advertising Dept.

New England Office, 48 Congress Street, Boston.
W. I. BARKER, Manager.

Western Office, 44 Lakeside Building, Chicago.
E. L. POWERS, Manager.

SUBSCRIPTION, IN ADVANCE, ONE YEAR, $3.

(Postage Prepaid in the U. S. or Canada.)

CLUBS.—In clubs of 4 or more, $2.50 a year each; with a free extra copy to the getter-up of a club of 8.
Subscription to foreign countries, $4 a year.
In requesting your address changed, give **old** as well as new address.

THE ELECTRICAL WORLD
HAS THE LARGEST CIRCULATION
OF ANY ELECTRICAL JOURNAL PUBLISHED, AND IS
THE BEST ADVERTISING MEDIUM.

Advertising Rates are much lower than those of any other similar publication, circulation and standing considered, and vary according to space, position and number of insertions. Quotations promptly furnished on application covering these points.
Notices of Situations or Help Wanted, $1 to $2 an issue.
Subscriptions and communications relating to **Advertising** the **Business Department** should be addressed to
W. J. JOHNSTON, Publisher,
Potter Building, New York,
OR EITHER OF THE BRANCH OFFICES.

VOL. XI. NEW YORK, FEB. 18, 1888. No. 7.

CONTENTS.

ILLUSTRATED ARTICLES: PAGE.

Reflector Shade for Incandescent Lamps. 74
The New Edison Municipal Lamp 74
The Bentley-Knight Electric Railway System at Allegheny City 75
The Slattery Induction System 77
Dynamo-Electric Machinery in Telegraphy—The New Plant in the Western Union Building, New York 79

NEW BOOKS:

"Annuaire du Bureau des Longitudes" 74
"L'Année Electrique" 74

CORRESPONDENCE:

Remedies for Humming Wires 76
The Incandescent Lamp Freak 81
Winding Armatures and Polarity of Brushes 81
Electricity and Rats 81

EDITORIAL PARAGRAPHS 73

MISCELLANEOUS: PAGE.

The History of the National Electric Light Association 74
Electrolytically Formed Copper Pipes 74
Effects of Animal Organisms on Electro-Magnetic Action 74
The Annual Report of the Commissioner of Patents .. 76
A Soap Battery 78
The Lineff Electric Tramway 78
The Chicago Meeting of the Edison Association 80

SPECIAL CORRESPONDENCE:

New York Notes 81
New England Notes 81
Philadelphia Notes 82
Western Notes 82
English Notes 82

DEPARTMENTS:

The Telegraph 83
The Telephone 83
The Electric Light 83
Applications of Power 84
Personals 84
Miscellaneous Notes 84
Business Notices 84
Our Illustrated Record of Electrical Patents 86

Classification of Advertisements. THE rapid increase in the size and number of advertisements in THE ELECTRICAL WORLD has, we think, rendered necessary, in the interest alike of reader and advertiser, some system of classification for easy and quick reference. A new departure of that kind has therefore been made in this issue, and we trust that it will be found useful. In this week's paper will also be found some general notes of the various non-electrical industries and concerns that have found in electrical applications a new market. This directory of supplies, supplementing the index of advertisements, is very interesting if only for the wide range it shows the influence and requirements of the electrical arts to have.

The Patent Office Report. COMMISSIONER HALL'S report to Congress regarding the work of the Patent Office for 1887 is one of the most careful and exhaustive documents of its kind that have appeared for some years. Fears have been expressed from time to time that the present administration would be hostile to patents, but these fears should be entirely dispelled on the reading of such reports as those of Commissioners Montgomery and Hall. Whether this means that there never was any real hostility, or that familiarity with the patent system breeds admiration, it is certain that the attitude of these commissioners leaves nothing to be desired. Mr. Stockbridge's analysis of Commissioner Hall's report shows its temper very clearly. His figures, too, are instructive and may be studied with profit.

Where Some of the Copper Goes. THE effect of the high price of copper has already been felt and exemplified in electrical applications, though not yet to the extent that some anticipated. In England the postal telegraph officers are said to have stopped purchases of copper and we know of like instances in America. That the syndicate handling the market at the present time has studied the electrical situation is apparent, and M. Secretan, prime mover in the "trust," went so far as to remark the other day that electricity was increasing the demand and that "to light London alone would take a fifth of the present year's supplies of England and France." If things continue as they are, we shall not be surprised to see some of the wire or electrical companies going in for copper mining on their own account. Such action would not want for precedent.

The National Electric Light Association. ON the next page will be found a brief sketch of the growth and work of the National Electric Light Association, whose meeting takes pace at Pittsburgh next week. There are so many recent recruits in the ranks of electric lighting that to no small number the article will give the first opportunity of learning how the Association started and has reached its present standing. It is hardly necessary to point out that the Association has still much to carry out in order to consolidate itself and to represent thoroughly a grand industry. There is hard work to be done, and it must be done with serious intent. The retiring president has set an example of high endeavor for the good of the business, and has shaped the course of the Association on well-chosen lines. His three years of office have been years of prosperity, and the Association will be handed over by him to his successor in excellent condition for discharging the responsibilities that have fallen to it.

Electric Railway Conduits. WHILE experiments in applying the storage battery to the propulsion of street cars are being actively pushed, those who have pinned their faith to the conduit system have not been idle. Quite recently there has been put into commercial operation such a system which, according to reports, is working successfully. We refer to the Bentley-Knight electric railway operated in Allegheny and described in another column. The promoters of this system have steadfastly clung to their opinion that the conduit system is the only one suitable for city traffic. and they claim to have removed all the difficulties which such a system presents. It is plain that with ample provision for drainage and cleaning of the conduit, nothing ought to stand in the way of the success of a conduit system so carefully and scientifically worked out. The small loss of current which is said to be shown by actual experiment at Allegheny is evidence that the various points have been well considered.

Strength of Electrolytically Formed Copper. THE aluminium alloys produced electrically rank high in tensile strength and we are now brought face to face with a process by which electrolytically deposited copper is generally increased in strength by a process by which the crystals of copper formed in the bath are broken down immediately on their formation, and by which means the copper becomes very compact and tough. The process may to a certain extent be likened to that of drawing, in which the particles are brought into closer intimacy. As described in another column, seamless copper pipes can be produced, far exceeding in strength those made by the present process of brazing. This applies, of course, to pipes of sizes too large to draw. The process pursued by Messrs. Elmore in England may possibly have other applications in engineering work, the only drawback being the metal's lack of ductility, as it shows only from 5 to 7 per cent. elongation.

Electrolytic Deposition with Alternating Currents. WHEN reports first reached us to the effect that the electric deposition of metals had been accomplished by means of alternating currents, we were disposed to give it but little credit, but when, as we are now informed, an alternating current meter is constructed, acting upon a principle embodying the electrolytic deposition of metals, it is in order to inquire under what conditions such an action could take place. As yet we have no details of the action involved, but we may conceive a way in which it may be accomplished. Thus the meter might consist of an apparatus which commutates the alternating current and converts it into a direct one, which is then utilized for depositing the metal. This apparatus would probably involve some moving parts to effect the commutation, and this may be looked upon as a drawback to its application in a meter. Other methods may, however, be conceived by which such an effect could also be produced, and we leave it to our readers to think them out.

Series Incandescent Lamps. SIMPLE as it seems to operate incandescent lamps in series with a constant current, it has, nevertheless, required a large amount of study and experiment to overcome the difficulties which had to be met and which were not present in multiple distribution. Chief among these difficulties has been the providing of a suitable device for cutting out a lamp upon its failure. Although an apparently simple device to secure, it has nevertheless taken years of study to accomplish, and it may seem strange to say that several prominent inventors have discarded electro-magnetic devices and adopted chemical or others dependent upon different properties of the current. Mr. Bernstein, it will be remembered, employs a mixture of mercury paste and carbon as a cut-out, the paste being made conducting when electrolyzed by the current. In another column we show the latest device of Mr. Edison, in which the heating effect in connection with the peculiar action of the arc is employed to cut out the lamp. The device is admirably compact and the principle might, it seems, be utilized in other ways.

Non-Magnetic Magnetism. ONE of the most curious instances of a false conclusion drawn from an experiment is that presented in another column by a contributor. According to the latter, we are to believe that the interposition of an animal organism in an electrical circuit deprives the current of all magnetic properties, so that the most sensitive galvanometer is not affected by interposing a small section of the moist tongue in the circuit. Our correspondent does not give us special details of his experiments by which we could point out the error that evidently exists somewhere in them. If his conclusions are correct, however, it would be very bad for electric light installations, because, supposing a person to touch the terminals of a low volt machine, thus interposing an animal organism in the circuit, then, according to the theory of our contributor the machine will become demagnetized, and the result would be the extinction of all the lights. And carrying out this still further, it would appear that by the same reasoning it would be impossible to receive a death stroke from any machine, as the interposition of the body in the circuit would demagnetize the machine. Evidently, therefore, the labors of the commission on the execution of criminals by electricity have been wasted.

The Edison Convention. ALTHOUGH the Association of Edison Illuminating Companies sits with closed doors, we are enabled to give on another page a very full account of the business transacted at the convention in Chicago last week. While we do not admire the practice of excluding the press, we must say that for attention to its work and for neglect of junketing, the body sets no bad example. Its five sessions in two brief days were almost overloaded with work. We venture the hope that at some early day the Association will at least adopt the custom followed by other deliberative bodies not less exclusive, and divide its sessions into public and executive. As to the papers read, it will be seen that they covered a variety of interesting topics, and we are sorry to tantalize our readers by dismissing so many of the important ones with briefest mention. We regret that more of Mr. Vail's masterly analyses are not available for publication, since they relate to the most vital details of station construction and operation. Such figures as we do give are very suggestive as to lines of inquiry to be developed. For example, the fact brought out as to the life of dynamos is most encouraging, and we would like to see some one try to get at like data on the life of arc machines, and, in fact, of all classes of dynamos. Probably not a few of our readers would also be glad to have more of Mr. Jenks' sentiments as to incandescent lighting on high potentials, Mr. Mottram's views of alternating operations, Mr. E. H. Johnson's summary of litigation, and Mr. Edison's address on the great questions of distribution. In the absence of the details, it may be said that the convention brought to light no weakening of any kind in the faith of the leaders and workers within the Edison system as to the present and ultimate stability of their industry.

Electrical Welding. THE processes of working metals by means of electricity have, it seems, taken two entirely different directions, each of which is claimed to have its special advantages. The electric arc, which has for a long time been employed for the fusion of refractory materials to extract the metals contained within them, is now employed in the work of joining like and dissimilar metals, or, in other words, in welding them. This process seems to have considerable field for application, and instances are reported in which repairs have been effected by its means in a very short time which could not perhaps have been accomplished in any other way without considerable difficulty. We are also informed that, contrary to first impressions which might be formed thereon, the process leaves the metal practically unchanged in its character. This, however, has still to be proved, and there is evidence to the contrary. Attention is also called to the fact that it makes considerable difference which terminal the object to be welded is made, whether positive or negative; and it has been found to be necessary to employ the carbon auxiliary electrode as the positive in order to prevent the oxidization of the metal worked upon. In contradistinction to this process, that of Prof. Elihu Thomson shows the flexibility of all the applications of electricity. Here, as is well known, the arc is intentionally avoided, and the heat effects are obtained by the use of powerful currents sent through the material at the points to be joined. Of the future of this process, of which many have already seen the results, there can be no question. It has already been reduced to such a practical form that its general introduction is now a matter of comparatively but a few months. These processes, taken in connection with the electric furnaces now employed, show that a vast field is being opened for new development. The ground has already been broken and sown.

NEW BOOKS.

ANNUAIRE DU BUREAU DES LONGITUDES. Paris: Gauthiers-Villars & Fils. 5¾ × 6 in., 808 pp. Price, 50 cents.

Since the 7th of Messidor, of the year III —dating from the French Revolution—the Bureau des Longitudes has not permitted a year to pass without publishing its annual. Besides the practical tables which constitute the usual contents of the volume, the present issue contains more extended articles on statistics, mineralogy, meteorology, etc. It also contains a masterly study on the "Age of the Stars," by M. Janssen, notes on the photographic star map by Admiral Mouchez, and an excellent description of the voyage undertaken in the East by M. d'Abbadie for the purpose of measuring the magnetic co-ordinates.

L'ANNEE ELECTRIQUE. By Ph. Delahaye. 4th year, 1888. 4¾ × 7¼ in., 379 pp. Price, $1.25.

The progress which has been made in all branches of electricity during the past year has given M. Delahaye ample material for his latest annual. As usual it is replete with information, which is collected together in shape for easy reference. Those who are too busy to review for themselves the weekly progress recorded in the journals devoted to the subject, will find the present volume of considerable aid.

The History of the National Electric Light Association.

The beginnings of a body which now ranks foremost among those which represent great industries in this country were not particularly auspicious. The first meeting of the National Electric Light Association, the idea of whose organization came from Mr. George S. Bowen, of Elgin, Ill, was held in February, 1885, at the Grand Pacific Hotel, Chicago. The convention was called to order by Mr. W. A. Hovey, and Mr. J F. Morrison was elected to the chair, being presented by Mr. C. A. Brown, in the name of the Western Electric Company, with a gavel modeled after a dynamo commutator. The discussions were loose but interesting, and it was felt by all that the right step had been taken in behalf of the electric lighting business. The committee on permanent organization made its report as to constitution, which was accepted, and Mr. Morrison was chosen president.

The next meeting was called in New York on August 18 the same year. A number of interesting papers were read and the association received great stimulus and added to its membership. The third meeting took place at Baltimore, Md., on Feb. 10th 1886. It is memorable not only for the amount of work done, but for the lavish hospitality extended by Mr. Morrison, who was unanimously re-elected president. Suggestions were made looking to the establishment of a bureau of information, and the subject was advanced of mutual insurance of electric light stations. The new British wire gauge was adopted.

The fourth meeting was held at Detroit, Mich., on Aug. 31, 1886, when, owing to the unavoidable absence of the president, Mr. E. R. Weeks, vice-president, was called to order and conducted the proceedings with admirable discretion. The wire gauge question again came up, and a committee on it was appointed. Mr. A. Steuart outlined the organization of a legal bureau, and Mr. C. J. H. Woodbury, the insurance expert, reported adversely on the mutual insurance project. The subject of electric motors came up prominently.

The association convened, for the fifth time, at Philadelphia, on Feb. 15th, 1887, President Morrison in the chair. Mr. A. V. Garratt, of the wire gauge committee, reported progress as to the preparation of a new wire gauge for the association, and Mr. Steuart read a report on reforms in the patent system. Considerable attention was paid to the subject of alternating currents, and a committee was appointed on the safety of electric light wires.

The sixth meeting of the association was held in Boston on August 9, and proved by far the most successful of all. A bill creating a commission to revise the patent law was presented by Mr. Steuart, and Mr. Garratt submitted a table showing the mathematical properties of the metric wire gauge adopted by the association. The committee on proper insulation of wires, etc., made a report, but found themselves unable to do effective work without funds. Alternating currents and electric lighting apparatus for the new cruisers received special attention. A new constitution for the assoc ation was adopted. The convention closed with a visit to the Thomson-Houston company's factory at Lynn, and a banquet given by the company and the Boston Electric Club.

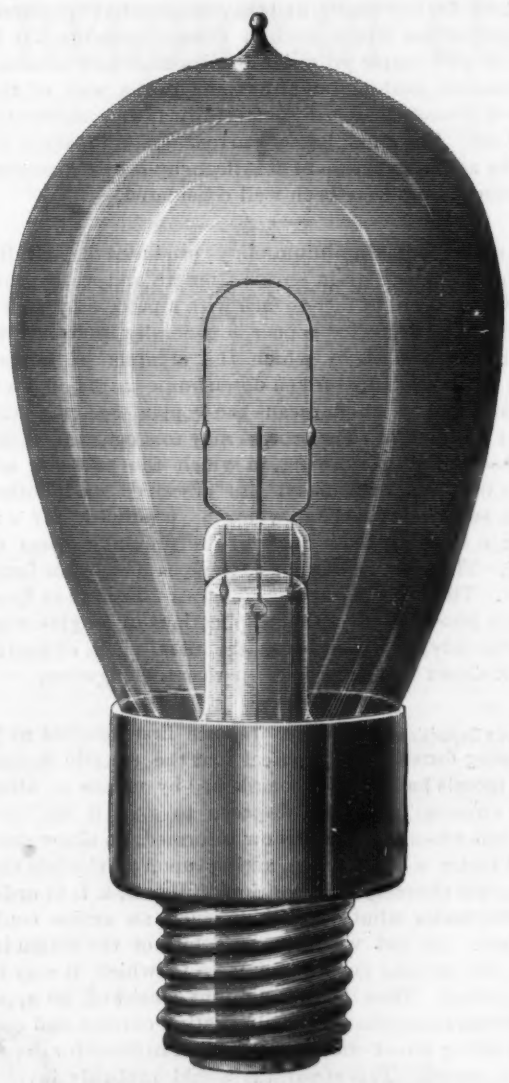
It need hardly be added that at each of the meetings a number of special papers on lighting, power, etc., were read. Among the authors may be mentioned Mr. E. R. Weeks, Dr. O. A. Moses, Lieut. Murdock, U. S. N., Dr. L. Waldo, Mr. M. M. M. Slattery, Mr. F. J. Sprague, Mr. A. Reckenzaun, Mr. C. O. Mailloux, Mr. C. C. Haskins, Prof. Houston, Mr. W. Baxter, Jr., Mr. A. F. Upton, Mr. C. J. Van Depoele, Mr. C. J. Kintner, Mr. J. W. Beane, Mr. F. Fosdick, Mr. R. W. Pope, Mr. A. S. Hickley, Mr. G. W. Parker, Mr. W. W. Leggett, and many others well-known in the electrical field. It deserves note, too, that throughout, Mr. Morrison, whose engagements now compel him to resign the office of president against the unanimous wish that he should retain it, has given his time and thought to the association in a way worthy of substantial recognition. He has been ably seconded by such officers as Mr. E. R. Weeks, Mr. A. J. De Camp, Mr. Frank Ridlon, Mr. F. A. Gilbert, Mr. E. T Lynch, Jr., and Mr. S. A. Duncan, who has been mentioned as Mr. Morrison's probable successor.

Reflector Shade for Incandescent Lamps.

Our illustration represents the reflector shade for incandescent lamps now being introduced by Mr. A. A. McCreary, of this city. The appliance is intended first as a

INCANDESCENT LAMP REFLECTOR SHADE.

reflector to concentrate the light upon the point where it is needed; and secondly, to diffuse it so that it shall not be a source of strain upon the eye. The upper part of the shade is shaped like a bell, with convex sides lined with silver, and the lower surface is of ground glass. The rays from the light are thrown against the silver and then reflected against the ground glass, which breaks up the rays, and the effect is a mass of light without direct rays. The shade can be attached to a gas-burner or to the incandescent electric lamp with no more trouble than an ordinary globe or shade. The light is said to be softened and



THE NEW EDISON MUNICIPAL LAMP.

whitened by its use, and it is said that the saving in the number of lamps used can be made very large. The shade will prove of great value to all persons engaged in literary or desk work of any kind, as the illumination is particularly soft and brilliant. One feature of the light that has been noticed is that it kills the glaze upon paper.

The New Edison Municipal Lamp.

In the Edison municipal system of incandescent lighting, as is well known, incandescent lamps of low resistance are placed in series on long circuits and fed with a constant current from dynamos giving an E. M. F. as high as 1,200 volts. With the incandescent lamps in series it is evidently necessary to provide a means by which the circuit is maintained continuous in the case of a lamp giving out, and various automatic cut-outs have been designed for this purpose. After experimenting for a long time for the purpose of obtaining a device which should be absolutely certain in its action, the Edison Company have now brought out a very simple and ingenious arrangement which is embodied entirely with the lamp, no external cut-out being required.

The new "Municipal" lamp, as now constructed, is shown in the accompanying illustration, and, as will be seen, has a platinum wire extending upwards a short distance between the two sides of the carbon horseshoe. This third wire passes down through the stem of the lamp outside of the vacuum, and is joined to fine iron wire holding a spring in tension. When the lamp breaks an arc is formed at the positive end of the carbon, and the current divides between the negative terminal and the central wire, the arc being attracted by the pointed end. The current thus diverted is sufficient to melt instantly the iron wire, thus liberating the spring under tension, which forces down a plug that short circuits the lamp, and extinguishes the arc.

This novel form of cut-out is said to be perfect in its operation, avoiding all the difficulties encountered with the older forms.

Effects of Animal Organism on Electro-Magnetic Action.

BY C. H. MURRAY.

I have recently (first observed on Jan. 22, 1888) discovered a heretofore unannounced fact in electricity, which is that the magnetism of an electric current is entirely extinguished by the current passing through an animal organism. I have made numerous tests under various conditions, and all with like results. The result is not affected by the subject being thoroughly insulated on glass or rubber. A current passing through the body will show no trace of magnetic properties at any point of its circuit, and the proximity of the electrodes has no modifying effect. If the ends of the wire carrying the current be held in the mouth only a millimetre apart, no matter how strong the current, it will have no effect whatever upon the most delicate galvanometer; it is destitute of magnetism.

I took two needles, both unmagnetized, and wrapping them around with fine insulated wire, placed the helix of one of them in the current circuit. In half a minute the needle was saturated with magnetism. I then placed the other needle in the current and passed the circuit through an insulated human body, and put on a much stronger current than before and continued it at intervals, altogether occupying several minutes. When the needle was taken from the helix not the slightest magnetism could be detected by any means. There is no variation with different persons.

I have not experimented with any of the lower animals, but I have no doubt that the law is general that all living animal organisms quench the magnetism of an electric current, so long as the animal organism is a part of the circuit of such current. May it not be probable that the sudden absorption of a large quantity of magnetism is the cause of death when a person receives a fatal shock of electricity? Or can we tell if the magnetism is absorbed?

The query is in order: What becomes of the magnetism in such a case? How can the influence of the person or persons in circuit extend back to the generating point of the current and so modify it as to prevent the ordinary magnetic whirl from accompanying the current on its circuit. I have not tried a galvanic current, but presume the result would be the same. The current experimented with was furnished by a small dynamo, and was, therefore, magneto-electric.

Electrolytically Formed Copper Pipes.

The recent accident to the steam pipe of the steamship "Elbe" lends a special interest to the electrolytic process for the manufacture of copper now being practiced by Mr. W. Elmore, at Cockermouth. According to this method, says *Engineering*, such an article as a steam pipe can be produced without weld or joint, and having a tensile strength from 50 to 100 per cent. in excess of first-class brazed pipes. Further, this result can be attained with the use of a very inferior quality of copper, and at a cost which will enable the electrolytically made article to compete in the market with the customary varieties. Of course there is nothing new in depositing copper in a tubular form, but hitherto such metal has been too brittle to render it reliable for use in circumstances under which it is exposed to great stress. For copying engraved plates, and for the rollers of calico-printing machines, deposited copper has been used with great success, and when it has been thrown down very slowly it has been possible to produce very satisfactory qualities of metal for these purposes. The novelty introduced by Mr. Elmore, however, lies in breaking down the crystals almost immediately they are formed, and pressing them out into a fibrous form in which they are interlaced and matted together. To this end the iron core or mandrel on which the metal is deposited is kept constantly rotating in the bath, and an agate burnisher is slowly moved backwards and forwards lengthwise of the cylinder, as if to cut a screw thread upon it. The speeds are so arranged that a layer of copper seven-thousandths of an inch

thick is deposited between each reciprocation of the burnisher. When the required thickness has been attained the mandrel is lifted out of the bath and placed in a vessel supplied with superheated steam. In a few moments the expansion of the copper detaches it from the iron, and the shell can be stripped off. Pieces cut from such tubes have been submitted to breaking tests by Messrs. Kirkaldy & Co., Prof. Kennedy and Prof. Unwin, and have broken at strains varying from 27 tons to 41 tons per square inch, with an extension varying from 5 per cent. to 7½ per cent. in a length of 10 inches. The metal can be worked under the hammer most easily, and can be drawn, bent or compessed without annealing, and without any tendency to crack. Specimens polished and submitted to the microscope show that the electrolytic metal has a perfectly compact and homogeneous structure, while drawn copper is a honeycombed mass of crystals, only connected together at points. The success which has attended the experimental stage of Mr. Elmore's process encourages the belief that absolute security from burst copper steam pipes can be secured in the future, and that we are on the eve of being supplied with a greatly improved quality of copper for all purposes.

Electrical Smoke Abatements.—A Vienna engineer named Fischer has just taken out a patent for a new smoke-abating process. He proposes, by means of electricity, to condense the solid part of the smoke as it arises from the coal, the carbon hu s solidified falling back into the furnace.

The Bentley Knight Electric Railway System, at Allegheny City, Pa.

We illustrate in this week's issue the Bentley-Knight system of electric street railways, in which the conductors are carried in a conduit laid below the surface of the street. The plant shown is now in operation on the Federal street line of the Observatory Hill passenger railway company, at Allegheny City, Pa. The construction of this road involved the solution of many difficult problems. The grades are excessively heavy, reaching $9\frac{8}{10}$ per cent. at the steepest point.

The conduit is both single and double track and the slot is carried through five other street railway tracks. The road was built under contract, stipulating that all the cars, each loaded with 9,000 pounds of passengers and each placed on a maximum grade, should at the same time climb the grades at speed exceeding 4 miles per hour.

Each of the four cars as shown in Fig. 1 is equipped with two 15 h. p. Thomson-Houston motors and each car carries contact devices for both overhead and conduit conductors. The cars have a speed on the heaviest grades of over 6 miles per hour while loaded with over 50 passengers, and on the approximately level part of the line have run at a speed of 15 to 18 miles per hour heavily loaded. Snow, slush and ice have all been met, and in no case have interfered with the working of the line. Tests made during heavy and continuous rain showed that the loss of energy on the whole 8 miles of conductors in circuit never reached 8 per cent.

The station plant contains a 200 h. p. Buckeye engine which runs four Thomson-Houston dynamos that supply the current both for operating the motors and the incandescent lamps in the station and on the cars. Natural gas is used for fuel.

The conduit, Figs 3 and 4, in which the conductors are carried is an important and interesting part of the system. In construction, the iron yokes were set upon the ties and their strengthening webs let into the ties themselves. This insured at all times perfect correspondence between rails and conduit. The continuous gutter between the yokes is formed of wood, carefully treated. The conductors are hung from a continuous insulating lining depending from the lips of the slot steels, and are connected by expansion joints. The slot steels used are somewhat heavier than those used with the cable system, extra strength having been needed on account of the heavy trucking of the city.

The lowest point of the yokes is less than 15 inches below the surface of the street, while the extreme width of excavation required by the conduit is 26 inches.

The contact-plows used to make connection between motors and conductors are provided with swivel joints, allowing them to easily take curves, and they are mounted on guides which give them full play across the whole width of the car. These plows (Fig. 5) can be inserted or withdrawn through the ¾-inch slot at any point along the line, and nothing can, by any accident, be left behind to obstruct the progress of succeeding cars.

The constant potential system is employed, the pressure

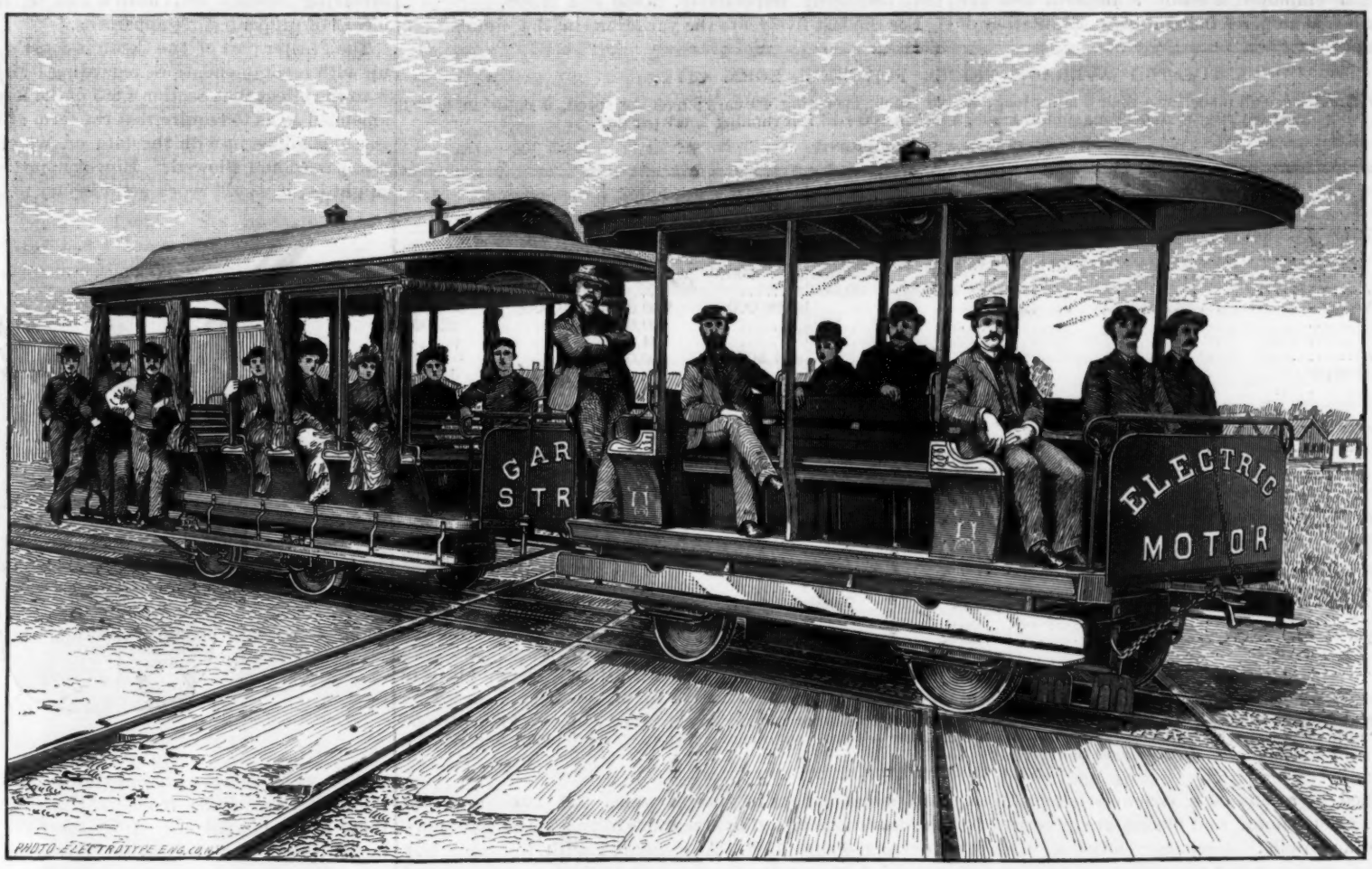


FIG. 1.—TRAIN OF CARS, BENTLEY-KNIGHT ELECTRIC RAILWAY.

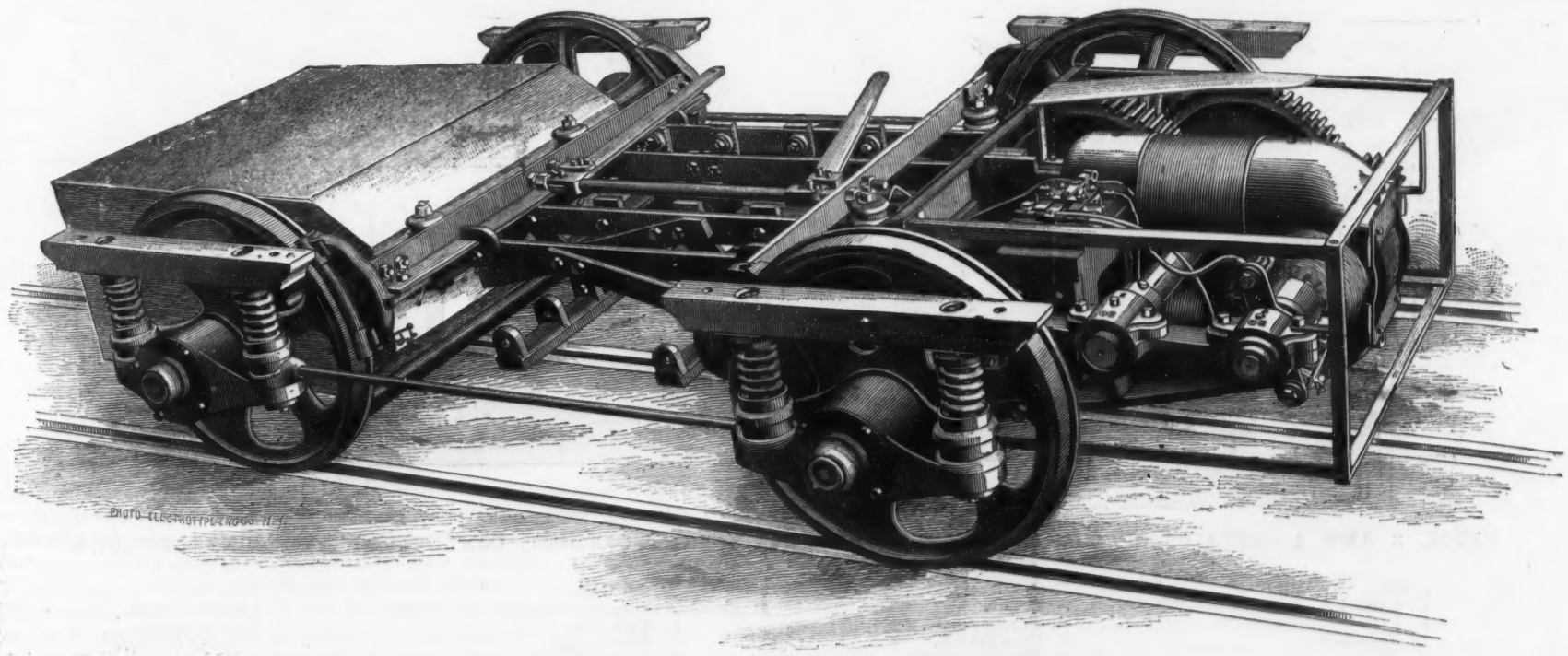


FIG. 2.—DOUBLE MOTOR TRUCK, BENTLEY-KNIGHT ELECTRIC RAILWAY.

remaining constant while the power is varied by the current. The dynamos are compound wound and provided with Prof. Thomson's new method of winding, in which the main circuit field coils closely surround the armature and oppose the tendency to a change in the line of commutation under varying loads. The machines have therefore a constant lead, and require but casual attention.

The efficiency of the motor is 90 per cent. The average current strength employed is about 7 amperes and the motor will stand 30 ampères indefinitely. Regulation of speed is effected by means of a coarse resistance in the motor circuit. Both motor and brakes are governed by an ordinary brake handle. A separate lever is used for reversing the mechanism when the car reaches the end of a trip. Toothed gearing is used throughout for transmitting the power of the motor to the axle.

In our last number we illustrated the standard truck of the Bentley-Knight Company and the system of elevated conductors used at Allegheny City on the suburban part of the same line. The truck shown in the engraving Fig. 2 has more than double the power which would be needed on any average city railway.

The engineers of the Bentley-Knight Company give the above comparative estimates for city work, which will be interesting. It is believed that in all cases maximum prices have been charged against the electric system and minimum prices against horses and cables.

ESTIMATED AVERAGE PRICES FOR NEW YORK CITY.

The following estimates are all made for a road 5 miles long, double track, operating 40 cars; average speed, 6 miles an hour; headway, 2½ minutes; maximum grade, 5 feet in 100; 16 full running hours per day.

CONSTRUCTION AND EQUIPMENT.

	Horse.		Electric.		Cable.	
10 miles track	@ $7,000	$70,000	@ $7,000	$70,000	@ $7,000	$70,000
40 cars	@ 850	34,000	@ 700†	28,000	@ 950‡	38,000
400 horses	@ 150	60,000	.....	.....	.....	.....
10 miles conduit	.....	.....	@ 25,000	250,000	@ 65,000‖	650,000
Steam plant	.....	.....	.....	20,000	.....	25,000
Dynamo plant	.....	.....	.....	24,000	.....	.....
40 motor trucks	.....	.....	@ 1,500	60,000	.....	.....
Machinery and sheaves	.....	.....	.....	.....	.....	10,000
Building	.....	40,000	.....	10,000	.....	10,000
Total		$204,000		$462,000		$803,000

ANNUAL RUNNING EXPENSES.

Feeding, replacing and caring for 400 horses	@ $219	$87,600	.....	.....	.....	.....
Coal, @ $2.50 per ton	.....	.....	.....	$7,756	.....	$9,581
Engineer and assistant, at $2.50 and $1.50	.....	.....	.....	1,460	.....	1,460
Firemen (2), at $1.50	.....	.....	.....	1,095	.....	1,095
Oiling sheaves	.....	.....	.....	.....	.....	4,000
Wear and tear	@ 5 %§	7,200	@ 3%	13,860	@ 3%	¶23,694
Maintaining cable	.....	.....	.....	.....	.....	13,200
Interest, @ six per cent	.....	12,240	.....	27,720	.....	48,180
Total		$107,040		$51,891		$101,210

Car-bodies cost from $700 to $1,200. † Axles and wheels are included in motor trucks. ‡ Including grip. ‖ From $50,000 to $100,000 per mile of track. Curves, crossings and switches constitute a heavy additional expense. § $204,000, less $60,000 (cost of horses). ¶ $803,000, less $13,200 (cost of cable).

Remedies for Humming Wires.

To the Editor of The Electrical World:

SIR: Will you kindly reply through the columns of your journal if there is any remedy for humming wires attached to buildings, and oblige a READER.

ANSWER.—A large number of devices have been designed to overcome the humming of wires. These "antihums," as they are called, are mostly based upon the principle of interposing springs which take the strain of the line wire and which prevent vibration. Several forms of the "antihum" are sold by dealers in electrical supplies.—EDS. E. W.

The Annual Report of the Commissioner of Patents to Congress.

BY G. H. STOCKBRIDGE.

The report of the Commissioner of Patents for the year ending Dec. 31, 1887, shows a total of 35,613 applications filed and 21,477 patents issued. This represents a slight falling off from the figures of 1886, the corresponding numbers that year being, respectively, 35,968 and 22,508.

For the last five years the variation in the number of patent applications has not exceeded 500, indicating that the conditions affecting inventions have stood substantially unchanged since 1882. As compared with the year last named, however, the five later years show an increase of 4,000 applications, and running back year by year to 1879, the increase since 1881 is about 9,500, since 1880 about 12,500, and since 1879 about 15,500. It is not so very long ago that the last figures would have covered the whole number of applications of a single year. As late as 1872 only 18,246 applications were filed.

The receipts of the Patent Office for 1887 were $1,144,509.60 and the expenditures $994,472.22. This leaves a profit of $150,037.38, making the Patent Office perhaps the best paying bureau under the Government. At all events the office has now to its credit in the Treasury of the United States over $3,000,000, accumulated mainly since 1860. It is no wonder that the Commissioner in this report urges that, with such a showing, the Patent Office ought to be accommodated with sufficient room so that its business can be conducted conveniently and efficiently.

The Commissioner treats this topic with sufficient plainness, following, it is true, the example of all his predecessors for at least a score of years. One might suppose that the heads of bureaus fill out their annual reports with suggestions and recommendations simply to make space. There is little evidence that Congress gives them the slightest attention. To carry their points bureau officers and even heads of departments have often to descend to the methods of the lobby. But until it ceases to draw votes to be a watch-dog of the Treasury, little amendment can be hoped for.

Touching the need of laboratory facilities, the Commissioner says: "Electrical processes and apparatus, such as the telephone and improvements in telegraphy, are so well recognized in importance and value as to require no comment, and yet the determination of whether a new invention has been made in these arts or an improvement involving novelty and utility can be reached only by means of proper testing apparatus."

The greater part of the Commissioner's report is taken up with recommendations regarding legislation. The first is to the effect that Section 4,885 of the Revised Statutes be amended so as to require that the term of the patent when issued shall begin with the date on which the application was passed and allowed. However just such a provision might be, it would work great injury to the American inventor, so long as the present statute remains concerning the limitation of the term of United States patents by those of foreign patents. Inventors have learned to avoid incurring the penalties of this statute by filing their foreign applications at or about the time of the issue here. This is now not difficult to arrange, as one can, after allowance, predetermine the date of issue by the time of paying the final fee, but to file foreign cases, trusting to the *allowance* of an application here on a given day would be a very risky matter.

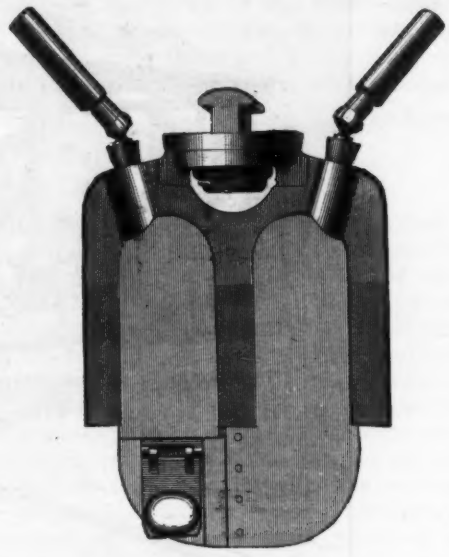
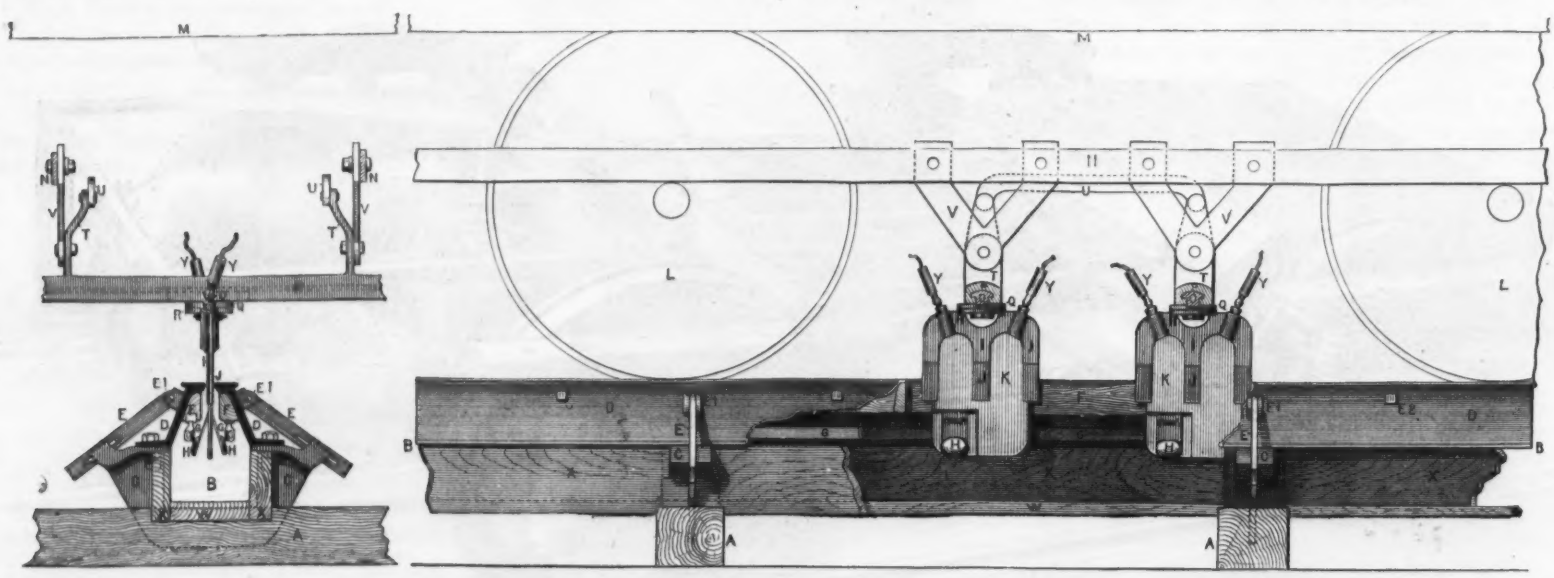


FIG. 5.—CONTACT PLOW.

The Commissioner removes much of the force of this objection by making a second recommendation which proposes the rescinding of the limitation referred to. If Mr. Commissioner Hall can accomplish this he will earn the gratitude of all that have to do with patents. The limitation clause is "a source of much vexation to inventors and of trouble to the Patent Office," and it is not of the slightest benefit to the American public. If a man wants to patent his invention abroad, he can do so without sacrificing his American interests, and there is nothing gained by surrounding the proceeding with artificial difficulties which, after all, effect nothing. The statute, which has already worked annoyance enough, finds a new chance for mischief in connection with the International Convention lately signed by the United States. The American inventor now has seven months after application here, within which to file applications in European countries. But, of course, no sane inventor will file his European applications before his case has been allowed in this country. If he should, the chances are ten to one



FIGS. 3 AND 4.—DETAILS OF CONSTRUCTION OF BENTLEY-KNIGHT CONDUIT, CONDUCTORS AND CONTACT-PLOWS.

A. Ties.
B. Conduit.
C. Yokes.
D. Slot-steels.
E. Braces.
*E*¹. Ears.
*E*². Lag-screws.
F. Slot steel lining.
G. Conductors.
H. Contact shoes.
I. Plow frames.
J. Wearing-plates.
K. Insulation.
L. Car wheel.
M. Car bottom.
N. Supporting frame.
O. Plow slide.
P. Plow guide.
Q. Upper bearing.
R. Lower bearing.
T. Plow lever.
U. Connecting rod.
V. Plow supports.
W. Conduit bottom.
X. Conduit sides.
Y. Flexible connections.

that the foreign patents would antedate and limit the American. On the other hand, how many American applications are passed to issue within seven months? Certainly very few of those which any one would think of patenting abroad. The result is that the International Convention might just as well not exist for all the good it does our inventors.

A third suggestion of the Commissioner is one that every honest man will support. He recommends that a recorded assignment of a patent shall be a valid notice to any purchaser for a valuable consideration, whose purchase is subsequent to the record, and this whether the record was made within three months or not. As now, an assignment should be valid for three months without record.

The Commissioner recommends further that the statute be modified so as to provide that a renewal application after forfeit must be filed within two years after the first allowance, in default of which the invention shall be regarded as abandoned to the public.

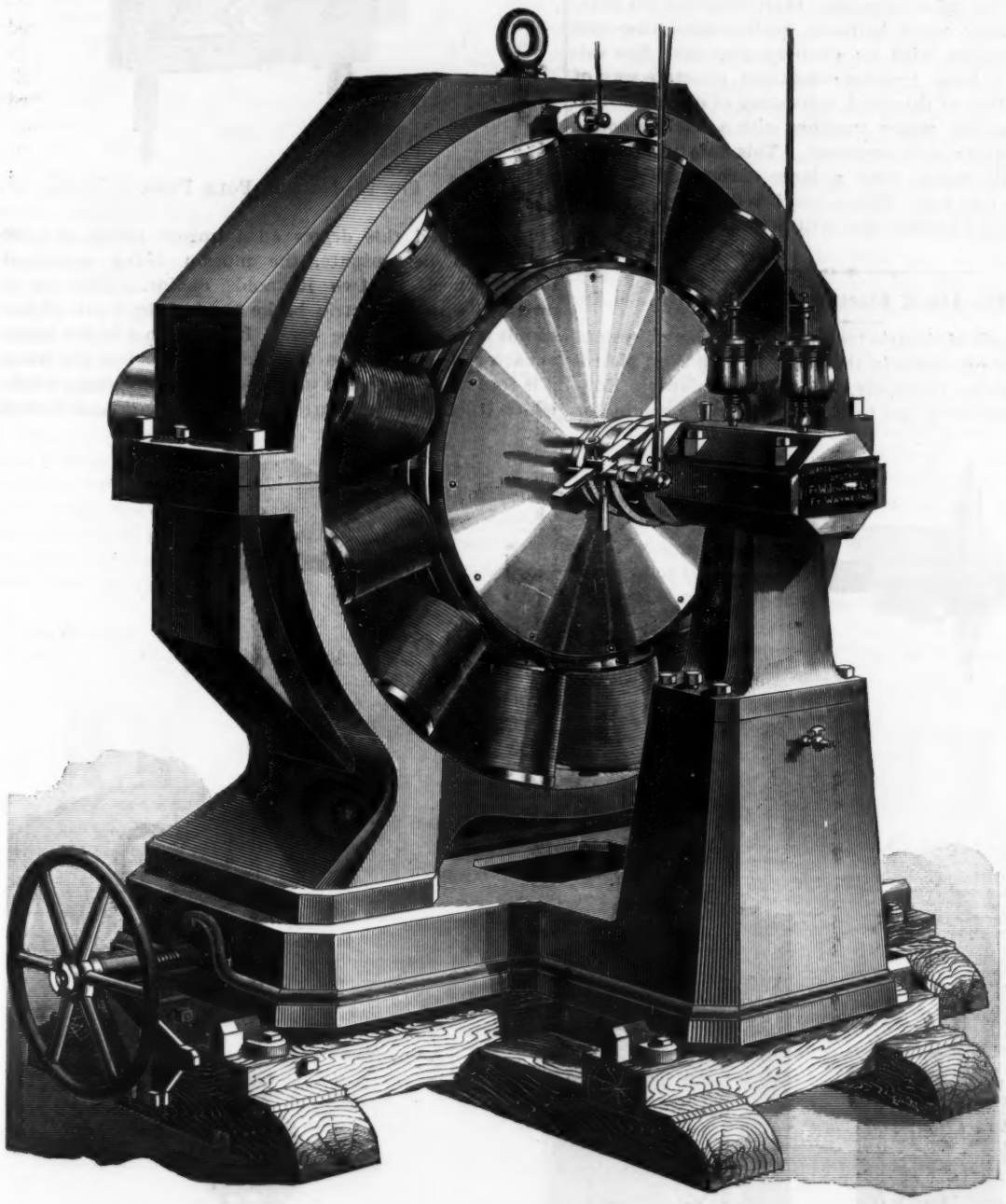
In the same connection, he recommends that the Commissioner of Patents be vested with a discretionary power to declare any application forfeited for lack of diligence in prosecuting it. I venture to think that such a discretion would be dangerous, and that, while the evil aimed at is a genuine one, it could be remedied by safer means.

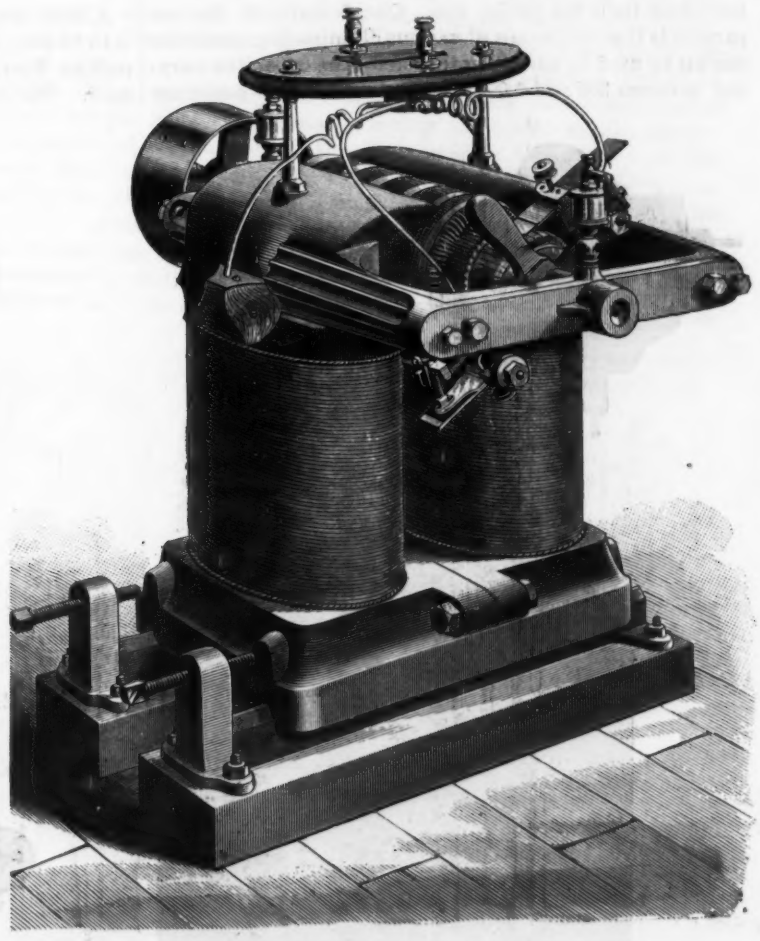
An excellent suggestion is that statutory provision be for preserving the validity of patents taken out in the name of joint inventors, provided either one of the parties joined was in fact the true and sole inventor. The relations to a supposed common invention of parties who have contributed to it in one way or another are sometimes very complex, and attorneys are often puzzled to know whether an invention is actually joint or sole. A provision like that suggested could work no harm, and would furnish an easy solution of a difficult problem.

The need of an act to cover trade marks used in inter state as well as foreign commerce is touched upon, as are also certain complications regarding trade marks arising from the International Convention.

The last recommendation of the Commissioner that concerns the modification of the present statutes is one in which he expresses the opinion that the Government should have power at its discretion to extinguish a patent by paying a reasonable consideration. I have not space to deal properly with this opinion here, but I believe there are grave objections to be urged against any scheme which puts such a power into the hands of the government. Discretionary power, to take the place of or supplement existing remedies, would not only be superfluous but sure to work injustice, and especially to the most meritorious inventions.

The report advocates the prosecution of the work of abridging United States patents which was begun several years ago but stopped for lack of appropriations. Other matters relating to measures of convenience and to relieving the Commissioner from embarrassment do not call for comment. Altogether the report is a very able and thoughtful document, showing the Commissioner to be fully alive to the duties and requirements of his office and to the needs of the service. His position regarding the patent system is an extreme one, but extreme in a direction that most inventors will be glad to note. "It is not the theory of the patent law," says the Commissioner, "that when the government grants a patent to an inventor it confers upon him any such property as it does in the case of a patent for land, which, belonging to the government at one moment, becomes the property of the patentee upon the execution of the instrument; but the patent in the former case recognizes the existence of the property in the individual, but in consequence of its intangible and incorporeal nature, it is incapable of protection from invasion by other persons, unless some distinct and specific remedy is afforded the inventor against such invasion and infringement." Very many inventors and manufacturers would be willing to stop short of this point and base the whole patent system upon expediency; but I fancy no quarrel will be raised with the Commissioner on that ground. In view of the Commissioner's report, inventors may well feel that their patent interests are committed to the hands of an intelligent friend of their cause.





FIGS. 1 AND 2.—GENERATOR AND EXCITER, SLATTERY INDUCTION SYSTEM.

The Slattery Induction System.

For some time past Mr. M. M. M. Slattery, whose work in the field of induction systems in the East is well known, has been engaged in developing a complete alternating current system for the Fort Wayne Jenney Electric Light Company. Mr. Slattery has been assisted in his work by Mr. Robt. MacKie and the accompanying engravings illustrate the details of the system. In deciding upon the particular type of dynamos most suitable for the work to be done, two were chosen, built, and put into practical operation. These types were the Siemens disc armature and the Lontin, and after careful and exhaustive test the Lontin type was selected, as illustrated in Fig. 1, for which, with other cuts, we are indebted to the *Western Electrician*. One size of the machine capable of supplying current for 1,800 16 c. p. lamps of 50 volts has 35 pounds of copper wire on the armature. The machine is separately excited by the dynamo shown in Fig. 2.

The converter is shown in exterior view in Fig. 3 and its interior construction is as follows: The copper wire is wound upon a core consisting of insulated iron plates, rectangular in form, divided centrally, and placed back to back, previously having had a sufficient portion of the centre cut out, in which space the coil referred to is wound. The magnetic circuit is then closed around the sides of this coil by the other half of the rectangular plate. The induction in this converter is equal to a volt per five inches of wire, the ratio of conversion twenty to one, and there are nearly two pounds of iron per secondary ampère capacity. The working pressure of the system is 1,000 volts at the terminals of the primary coil and 50 volts at the terminals of the secondary coil.

A special insulating compound is used in these converters, and this is of such a character that the chances of cross circuiting of the convolutions of the primary coils are very remote indeed. In each converter, conveniently placed, are primary and secondary fuses, which are easy of access. A simple device in connection with the primary fuse enables the attendant to cut the converter entirely out of circuit during the introduction of a new fuse, thereby enabling him, without danger, to make and leave everything secure about the connections of the apparatus.

The central station instruments, viz., pressure indicator and ammeter, are especially constructed for measurements of alternating currents and potentials, and are both simple in construction and extremely delicate in operation. A description of one instrument will answer for both. Two flat metallic spools divided at one side have wound thereon the requisite number of convolutions of wire. These spools are mounted upon a rectangular frame common to both, one being placed in eccentric relation to the other, in order to modify the parallel plane of the convolutions of the respective coils, for the purpose of reducing self-induction. In order to obtain a due and proportional measurement of current or potential in relation to the spools, a circumferentially disposed inverted horseshoe shaped piece of iron is attached to a central shaft, which is mounted upon jeweled centres, and carries a pointer, which is deflected according to the varying potentials and strength of current. The instruments are placed in a case having a glass front, and are disposed in a conspicuous position in the central station, so that the attendants may see at any moment what is taking place in the external circuit. Not the least of the important factors in this system is a meter for measuring the energy supplied to each customer. A simple central station device is also used for safely and easily coupling alternating current dynamos in multiple arc.

Another useful central station apparatus, devised by Mr. Slattery, is chiefly to be used by central station superintendents. This device is placed by the superintendent in proper relation in the circuit for the work it has to do —at night, for instance, as he leaves the station. In the morning when he returns he consults the apparatus, and

sees exactly the extent of the irregularity due to the carelessness of the attendant, and the electrical disturbance which may have taken place during his absence. This will, no doubt, commend itself to central station superintendents as a means of compelling, if possible, more careful performance of duty, a laxity in which has frequently resulted in irregularities.

Mr. Slattery has also constructed a special converter for

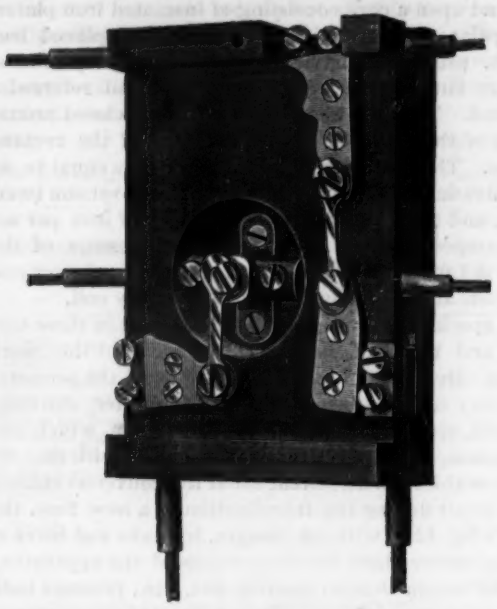


FIG. 8.—FUSE BOX, SECONDARY CIRCUIT.

operating arc lamps in multiple arc, which, although it has not yet been placed on the market, has been for some time working successfully at the factory, and preparations are now being made to manufacture these lamps and introduce them for public use. One feature of this apparatus is that arc lamps of various illuminating capacities can all be used in one general system, the capacities varying between 300 and 2,000 candle-power. The converter constructed to work in connection with this lamp is only a trifle larger than an ordinary exterior arc lamp cut-out, and in consequence of its compactness, may be disposed of with as much ease.

The motor designed for this system is still in an experimental stage.

The engraving, Fig. 4, shows an adjustable clamp branch connector, used to connect branches with the main line, and enables the linemen to dispense with the use of solder, rendering the work more expeditious, and making a very effectual joint. In conjunction with this branch connector, is used a branch switch safety fuse, Fig. 5, which is placed at the junction of a primary branch and the main line. Here again the safety of those whose duty it is to replace burnt-out fuses is considered, as they can by means of the switch, shown in the interior of the fuse box, disconnect the fuse terminal from the line and then safely adjust the fuse. One of these boxes is placed on each side of a parallel circuit. Figs. 6 and 7 are smaller sizes of the apparatus, shown in Figs. 4 and 5, and are employed to connect the primary coil of the converter with the external primary circuit. This method of introducing so many fusible devices throughout the system might be considered by some as superfluous, but if there is an error in question at all it will be considered as being on the side of safety.

Figs. 8 and 9 represent the fusible wiring details, the special object in the construction of which has been greater facility in wiring and safety when wired. Fig. 10 represents the lamp, shade-holder and key-socket. The lamps have a working life of about eight hundred hours, and it is claimed that twelve 16 candle-power 50 volt lamps can be operated with the expenditure of one horse-power of energy.

A Soap Battery.

BY A. V. MESEROLE.

Many different substances have been proposed for making dry, or rather, moist batteries, such as sand, saw-dust or plaster saturated with an exciting chemical like sal-ammoniac. I have found a cheap and effective way of making a battery of this kind, consisting of common soap dissolved in boiling water together with a small amount of bran and caustic soda or potash. This mixture is put in a jar while warm with a large carbon pole and an amalgamated zinc rod. When cold it sets something like jelly and makes a battery that will not readily evaporate or slop over.

The Lineff Electric Tramway.

A short length of electric tramway on the Lineff system is to be seen in operation in the depot of the West Metropolitan Tramway Company, Highroad, Chiswick, England. The current is led to the car through a conductor laid in a tube or trench in the centre of the track. The copper strand or rod which carries the current is contained within an iron pipe carried in brackets bolted to the side of the trough. This tube is covered with insulating compound, and between it and each of the brackets there is interposed a layer of non-conducting material. About every 4 feet there occurs in the pipe a T-piece pointing upward, and into each of these fittings there is screwed a plug which binds tightly against the copper conductor at the bottom, and at the top carries a trough-like head. This head serves to convey the current to a flexible contact piece carried by two gripper arms which are fastened to the car and pass through a slot formed in the top of the trench. Between the arms there is loosely stretched a wire rope on which are threaded a number of gun-metal ferrules to give it weight. This rope lies in the trough-like heads of the plugs mentioned above, making contact with four or five of them at a time. The current then flows up the gripper arms to the motor on the car. In the example shown, there is a current of 10 ampères and

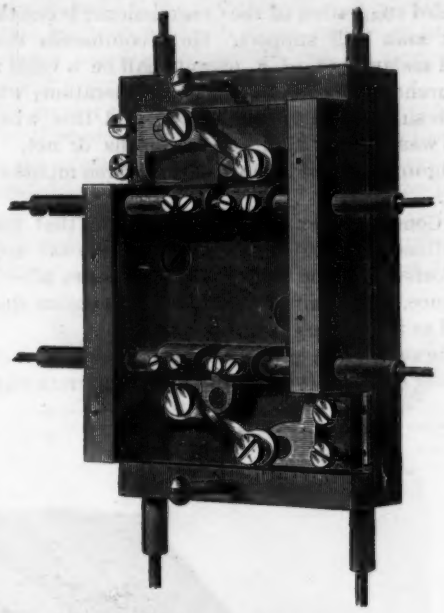
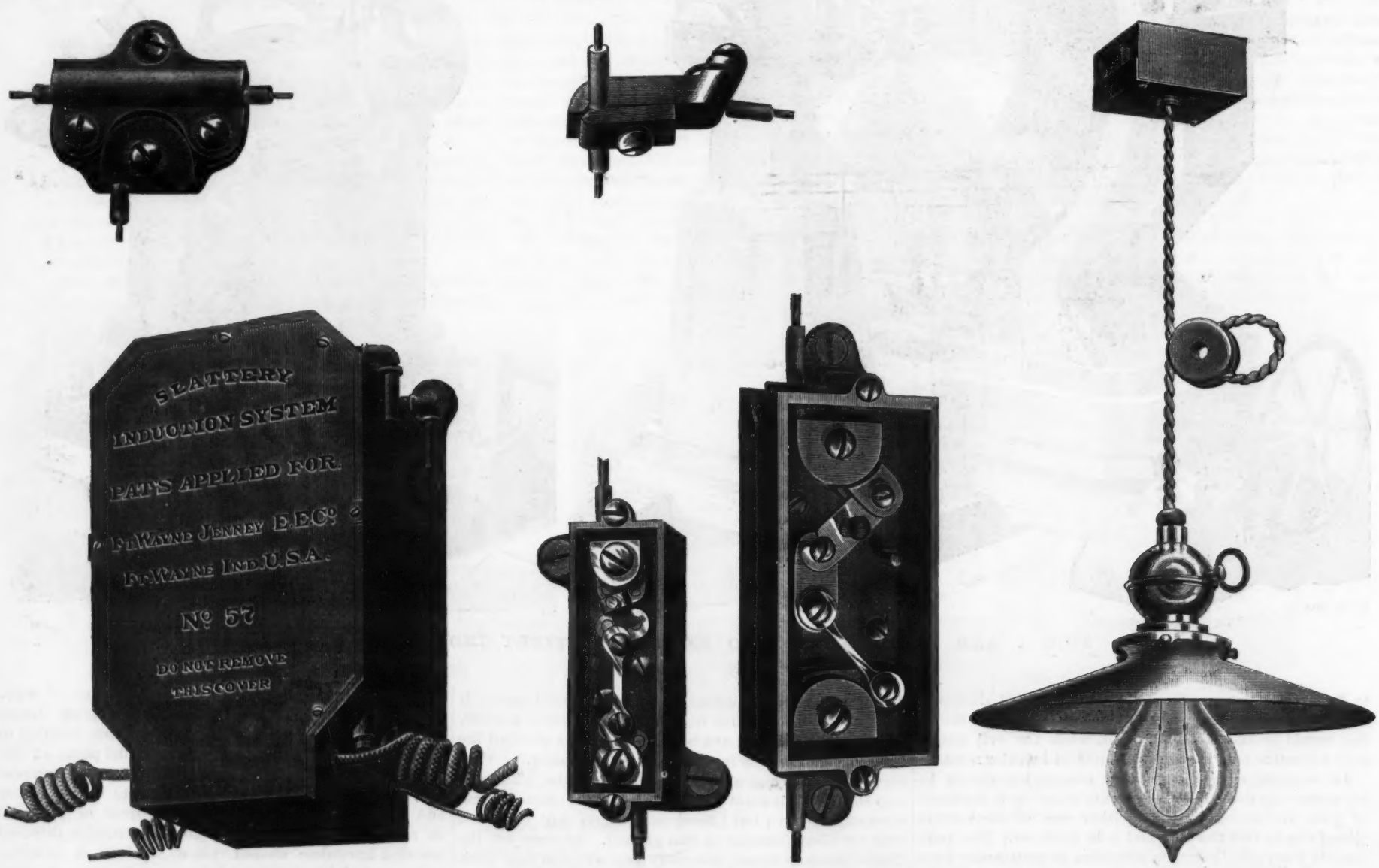


FIG. 9.—DOUBLE POLE FUSE.

220 volts, and this drives an Immisch motor at 1,000 revolutions per minute, the motion being conveyed to the wheels by two Reynolds chains. The car is provided with an electric brake worked by a pair of solenoids and a horseshoe core. It has also a buffer board at each end. If this board strikes an object on the track it is forced inwards, and in moving it operates a switch, which (1) cuts off the current from the motor and directs it into the brake magnet; (2) reverses the brushes on the motor, and (3) switches the current back into the motor. Thus the car is automatically reversed. It will be seen that the general arrangement of the electric tramway is similar to that in use in Blackpool, and that the novelty lies in the method of carrying the conductor, and making contact between it and the car.



FIGS. 3, 4, 5, 6, 7 AND 10.—DETAILS OF SLATTERY INDUCTION SYSTEM.

On German Railways.—The telephone is being largely employed on the German railways, thirty of which have already adopted it, either tentatively or otherwise. The most favorable results have been obtained in using it on branch lines, where it is now employed almost exclusively.—*Manufacturers' Gazette.*

Dynamo-Electric Machines in Telegraphy. The New Plant in the Western Union Building, New York.

BY WM. MAVER, JR.

II.

Referring again to Fig. 2 in last week's issue and alluding to my remark concerning the course of the current through the field coils, the point would, perhaps, have been better stated as follows: "Were the machine *E* simply a resistance and the field coils of the machines *A*, *B*, *C*, *D* a simple shunt from the main circuit, the direction of the current from said machines through such a shunt would, of course, be in an opposite direction to that shown by the arrows in the figure, etc."

It will have been obvious to the reader that the chief cause of the defect in the original plant mentioned in Part I. of this article was the comparatively high resistance of

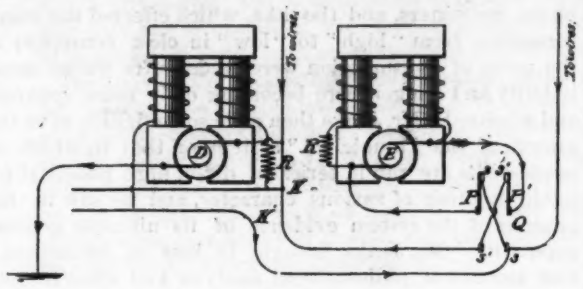


FIG. 3.

the armature of the machines added to the not readily foreseen, rapid and large increase in the number of circuits to be supplied with current.

I have already stated that in the former arrangement of the machines one of the series was permanently connected to furnish positive, the other series negative polarity, and the spare series was arranged to supply either positive or negative polarity as desired. In the new plant the spare series, by means of a commutator and ingenious connections also furnishes either positive or negative polarity.

In the original arrangement, as previously noted, this change was made by means of a commutator which reversed, in a well-known way, the direction of the current flowing from the exciter *A*, Fig. 1, through the field magnet circuits of the other four machines. In the new arrangement, however, more than the simple reversing of the current flowing through the field magnet circuits of the machines *A*, *B*, *C* and *D* is required, namely, that while the current from machine *E*, passing through the field magnet coils of those machines, is reversed, the current in its own field coils and armature must remain permanently in the same direction, and, at the same time, the current which it supplies to the wires must be reversed, in common with the other machines. This involved a neat little problem, which was also satisfactorily solved by Messrs. Brown and Hamilton.

The device for this purpose is shown in Fig. 3. Machines *D* and *E* only are shown. *Q* is the commutator, to the points *P P'* of which the leads from machine *E* are brought. *P P'* are brass levers, hinged on a common frame, but insulated from each other. *S S S' S'* are brass springs, *S S* and *S' S'* being respectively joined together by metal strips, as shown. A lead from machine *D* and one from the field-magnet circuit of machines *A*, *B*, *C* and *D* is joined at *K*, and the joint lead is then brought to *S'* of the commutator. The other lead of the field magnet circuits, *K'*, is brought to *S*. So also is a main lead to the outside wires. As already said, the current through machine *E* is never reversed. In the position of the commutator shown in Fig. 3 the spring *S* rests against lever *P*, and *S'* against *P'*, and the current flows as indicated. When the frame supporting *P P'* is turned down on its hinges, as shown in Fig. 4, *P* rests against *S'*, and *P'* against *S*, and the current in the fields of *A*, *B*, *C*, *D*, as well as that going to the wires from *E*, is reversed, as shown by the arrows. But the direction of the current through *E* and its field-magnet coil remains as before.

Fig. 5 shows two series of the new plant, and the actual working connections between it and the switch-board in the operating room. The series furnishing the positive polarity permanently and the spare series are supposed to be shown. The connecting wire between each machine of a series is run direct from machine to machine, except in the case of the spare series, where a change is necessary, the leads from the fifth machine of that series being run direct to the commutator *Q*.

The leads conveying the different potentials to the main switch-board in the operating room are first brought to a switch-board *S* in the dynamo room. This switch consists of five rows of heavy brass discs. To the discs 1, 2, 3, 4, 5 of the first horizontal row, the 1st, 2d, 3d, 4th and 5th machines of the permanent positive polarity series are led. Similar "potentials" of the spare series are brought to similarly numbered discs of the third row, as shown. The leads of the machines permanently furnishing negative polarity are brought to the fifth row of discs, although not shown in the figure.

The second and fourth rows of discs are connected with the positive and negative leads, and these leads are run directly to the brass strips *B* behind the operating room switch-board, practically as in the old arrangement. In the diagram it is seen that the first row of discs is connected by plugs to the second row, and that the third and fourth rows of discs are connected together in the same way; and as this requires the spare series to supply negative polarity, the commutator *Q* is arranged to cause the spare series to furnish it accordingly. It will also be seen that by simply transposing plugs from the third and fourth rows of discs to the third and second rows, the spare series will be connected with the positive leads, and that transposing the plugs to the fourth and fifth rows would cut out the spare series and cut in the negative series.

It is, of course, imperatively necessary that the change from either of the "permanent" series to the emergency series, or *vice versa*, should be accomplished without a moment's interruption of the current, and the switch permits of this. It is done by simply plugging up the discs which place the spare series in multiple arc with the series to be released, after which that series is cut out.

It is quite essential also that the attendant of these machines should have some ready means of ascertaining whether the positive and negative series are furnishing equal currents to the wires. To enable him to do so the differential galvanometer *G* is connected with the fifth potential leads of both the negative and positive polarities, through a resistance of about 3,500 ohms, as shown. When the currents are equal in both sides of the galvanometer the needle stands at zero. Any inequality is indicated by a deflection of the needle. It may be explained that the necessity for this practically exact equality of currents from the different series lies chiefly in the fact that in the quadruplex and the polar duplex systems the negative and positive polarities are used alternately, and any marked unevenness in the poles would be injurious to the working of the systems.

The commutator *Q* at the right is shown separately in Figs. 3 and 4.

It will be noticed that the German silver coils previously alluded to and shown in Fig. 1 as resting on the brass strips *R* behind the switch-board have been replaced in Fig. 5 by incandescent lamps as a means of interposing resistance in each circuit. This change has not yet been actually made, but arrangements are in progress to that end. The German silver wire is wound in one layer around a plaster of Paris cylinder. As the largest of the cylinders is about 1 foot long by 3 inches in diameter, the wire, to have a resistance of, say 600 ohms, is necessarily fine, and more or less trouble is caused by its breaking. These breaks occur most numerously in very moist weather and it is therefrom inferred that the breaks at such time are due chiefly to swelling of the plaster.

The lamps which are to replace the coils will have a re-

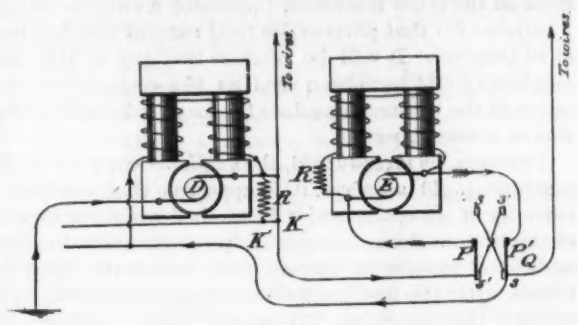


FIG. 4.

sistance of about 200 ohms each, and as it is probable that they will never be brought to incandescence (the maximum current on any one telegraph circuit rarely exceeding .2 to .3 of an ampère even in case of short circuiting, the average being very much less), it is expected that they will have a long life as simple resistances. Other forms of resistance for this purpose could, of course, have been devised; but it is believed that these lamps will answer very well, especially as it is desirable to have the resistance within sight and readily removable in case of breaks. The space to be occupied is also an important consideration. It is designed to use three of these lamps on the majority of the circuits, and they will be placed in sockets as in ordinary electric lighting circuits, only slight and obvious modifications of the socket being necessary.

The dynamo electric machines of the new plant were made by the Edison United Manufacturing Company. They are the Edison No. 2 machines, and have an available capacity of 40 ampères each. The resistance of the armature is about .1 ohm each; that of the field magnet coils about 30 ohms each. Each series of machines is driven by a 15 h. p. steam engine. The machines are run at about 1,200 revolutions per minute.

The first and second machines, *A* and *B*, furnish an electromotive force of 70 volts each; the third and fourth machines, *C* and *D*, 60 volts each; and the fifth machine, *E*, 65 volts; making a total electromotive force of 325 volts. These are divided into grades of 70, 140, 200, 260 and 325 volts, known as the 1st, 2d, 3d, 4th and 5th potentials, respectively.

The number of wires "fed" from the 1st potential of each series is about 160, having an average resistance of 3,000 ohms. About 135 wires of an average resistance of 3,500 take current from the 2d potential. About 80 of an average resistance of 4,000 from the 3d; and about 40 wires of an average resistance of 5,000 from the 4th and

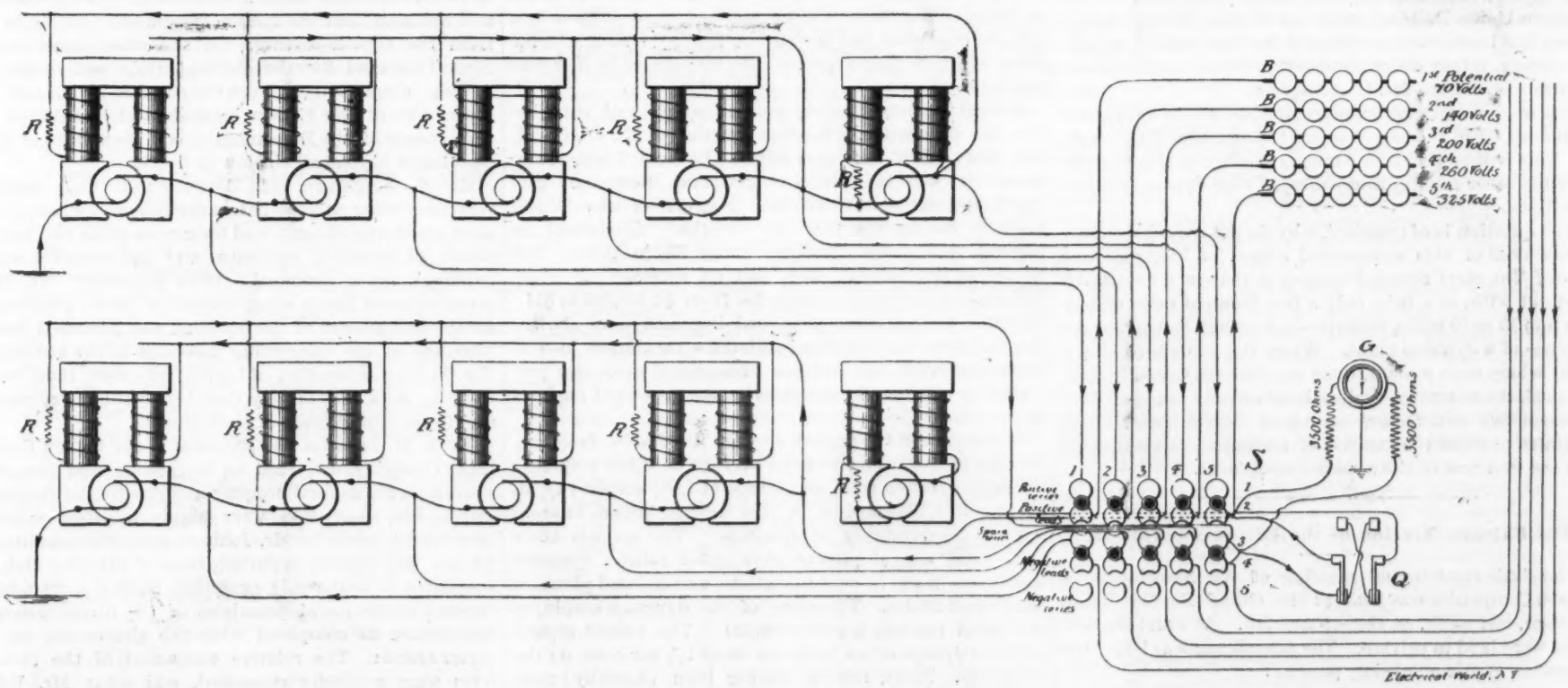


FIG. 5.—DIAGRAM OF CIRCUITS AND SWITCHBOARD, NEW WESTERN UNION DYNAMO TELEGRAPH PLANT.

5th potentials. In addition, several motors used in the service of the commercial news department are supplied with current from the 2d potential.

It is plain that the first machine *A* of either series is the one most heavily drawn upon, as its external resistance is the joint resistance of the field coils and of all the wires fed by itself and the other four machines.

In fair weather it has been found, by measurement, to yield about 16 ampères, and in very bad weather, about 23 ampères, showing an external resistance of about 3 ohms at such time. The current furnished by the second machine, *B*, in bad weather is about 13 ampères; that of the third machine, *C*, about 10 ampères; that of the fourth machine, *D*, about 8 ampères, and that of the fifth machine, *E*, so far as the outside wires are concerned, about 3 ampères. As the latter, however, excites its own field and those of the other machines, furnishing a current of over 7 ampères for that purpose, its total current may be placed at 10 ampères. It will be obvious that any of the other machines could have been used as the exciter, but inasmuch as the last machine does the least external work, it was of course chosen.

Although, as already said, the available capacity of each machine is 40 ampères, it is apparent that the limit of capacity of an entire series is reached when the capacity of the first machine *A* is attained, as an attempt to supply additional wires with current from any of the other machines, after the first machine has reached its limit, would overtax that machine. It is not likely, however, that this limit will be reached for a long time to come.

The efficiency, and especially the economy, of these machines was recently well exemplified when the Baltimore & Ohio Telegraph Company's circuits were transferred to the Western Union building. Those circuits in their operation by the former company required the use of about 8,000 cells of gravity battery. They are being "fed" by these machines without any marked increase in the total output.

It is worthy of note that the change from the old to the new plant was effected so smoothly that the change was not perceptible in the operating room. The change was made on the same general plan as that described above, as employed in the change from one of the permanent series to the spare series. That is, the two series of the new plant were connected to run in parallel with the corresponding series of the old plant, and when the new plant was well under way the former was cut out.

It is interesting also to note that during the eight years that dynamo-electric machines have been used in the Western Union Building only one or two trifling delays of any kind have been occasioned by any defect of the machinery, a fact which certainly reflects credit on the engineer in charge, Mr. O. A. Brown.

It is understood that the original plant will be forwarded to and set up in the new Western Union office, Pittsburgh, Pa. This will be the second telegraph office in this or probably any other country thus equipped with dynamo-electric machines.

The question is of tenasked, why do not opposition companies avail of this economical source of electromotive force? The chief reason doubtless is that such companies start out with, as a rule, only a few hundred cells of battery and 15 or 20 wires, perhaps—not enough to warrant the expense of a dynamo plant. When the system attains a point where such a plant, once established, would be economical, the company, finding itself already equipped with a reasonably satisfactory source of electromotive force, hesitates to incur the expense of preliminary experiments and the first cost of the dynamo equipment.

The Chicago Meeting of the Edison Association.

The sixth semi-annual meeting of the Association of Edison Companies was held at the Grand Pacific Hotel, Chicago, last week, on the 8th and 9th. As usual the sessions were held in private. The attendance was large, the following gentlemen being present:

T. A. Edison.
E. H. Johnson, Pres't Edison El. Light Co., N. Y.
J. H. McClement, Comptroller Edison El. Light Co., N. Y.
J. H. Vail, Genl. Supt. Edison El. Light Co., N. Y.
L. Stieringer, Expert Edison El. Light Co., N. Y.
W. J. Jenk, Secretary Standardizing Bureau Edison El. Light Co., N. Y.
Charles R. Deane, Director Standardizing Bureau Edison El. Light Co., N. Y.
C. E. Chinnock, Vice-Pres't Ed. United Mfg. Co., N. J.
Sam'l Insull, Genl. Manager Ed. Mch. Works, Schenectady, N. Y.
F. R. Upton, Treas. Edison Lamp Co., Harrison, N. J.
J. W. Howell, Electrician Edison Lamp Co., Harrison, N. J.
F. E. Jackson, Assistant Electrician Edison Lamp Co., Harrison, N. J.
B. F. Card, Agent Edison Lamp Co., Harrison, N. Y.
S. Bergmann, Bergmann & Co., N. Y. City.
Geo. Peck, Pres't Ed. Ill. Co., Detroit, Mich.
J. R. McLaughlin, Director Ed. Ill. Co., Detroit, Mich.
C. P. Gilbert, Sec. and Man. Ed. Ill. Co., Detroit, Mich.
E. W. Voight, Vice-Prest. Ed. Ill. Co., Detroit, Mich.
J. R. Markle, Markle Eng. Co., Detroit, Mich.
John I. Beggs, Vice-Prest. and Gen. Man. Ed. Ill. Co., New York City.
Arthur Huertly, Asst. Sec. Ed. Ill. Co., Chicago, Ill.
D. H. Lauderback, stockholder Ed. Ill. Co., Chicago, Ill.
A. L. Smith, Prest., Appleton, Wis.
W. F. Wollin, Gen. Man., Ed. Ill. Co., Lancaster, Pa.
W. W. King, Supt. Ed. Ill. Co., Topeka, Kan.
Thos. P. Merritt, Prest. Ed. Ill. Co., Reading, Pa.
C. L. Edgar, Gen. Supt. Ed. Ill. Co., Boston, Mass.
E. R. Weeks, Gen. Man. Ed. Ill. Co., Kansas City, Mo.
Chas. R. Price, Treas., New Bedford, Mass.
E. Z. Wallower, Prest. Ed. Ill. Co., Harrisburg, Pa.
M. N. Grant, Prest. Ed. Ill. Co., Laramie, Wyo.
R. M. Jones, Sec. & Man. Ed. Ill. Co., Laramie, Wyo.
W. M. Mottram, Supt. Ed. Ill. Co., New Orleans, La.
Geo. W. Carter, Sec'y Ed. Ill. Co., Jackson, Mich.
C. W. Fowler, stockholder Ed. Ill. Co., Jackson, Mich.
J. C. Wilson, Supt. Ed. Ill. Co., Jackson, Mich.
B. K. Jamieson, Vice-Pres. Ed. Ill. Co., Phila., Pa.
W. D. Marks, Supt. Engr. Ed. Ill. Co., Phila., Pa.
Chr. Wustenfeld, Mgr. Ed. Ill. Co., Elgin, Ill.
J. E. Parrish, Supt. Ed. Ill. Co., Scranton, Pa.
Dan'l McCoy, Pres. Ed. Ill. Co., Grand Rapids, Mich.
Chas. M. Ayer, Sec'y and Treas. Ed. Ill. Co., Grand Rapids, Mich.
J. W. Crosby, Supt. Ed. Ill. Co., Grand Rapids, Mich.
C. H. Lindenberg, Pres Ed. Ill. Co., Columbus, O.
Will. C. Turner, Sec'y and Gen. Man. Ed. Ill. Co., Columbus, O.
G. P. Dennis, Pres. and Man. Ed. Ill. Co., Chester, Pa.
H. K. McCoy, Supt. and Electrician Ed. Ill. Co., Birmingham, Ala.
E. S. Bentley, Sec'y and Treas. Ed. Ill. Co., La Crosse, Wis.
W. D. Kurz, Supt. Ed. Ill. Co., La Crosse, Wis.
F. G. Kurz, Supt. Ed. Ill. Co., Appleton, Wis.
F. D. Smith, Mgr. Ed. Ill. Co., Pontiac, Mich.
B. B. Powell, Sec'y and Mgr. Ed. Lamp, Light and Power Co., Sault Ste. Marie, Mich.
Wilson S. Howell, Electrician Ed. El. Ill. Co., Williamsport, Pa.
W. E. Carlin, Sec'y and Treas. Ed. El. Ill. Co., Jerseyville, Ill.
H. Ward Leonard, of Leonard & Izard, licensed contractors, Chicago, Ill.
C. M. Barclay, Vice-Pres't, Oskaloosa, Iowa.
W. Oswald, agent Edison United Mfg. Co., New Orleans, La.
Wm. D. MacQuesten, Western Elec. Const'n Co., Kansas City, Mo.
H. McL. Harding, Gen'l Agt. Sprague El. Ry. & Motor Co., New York, N. Y.
F. S. Gorton, Sec. and Treas. the Chicago Edison Co., Chicago, Ill.
A. T. Seeberger, Pres't Ed. Ill. Light Co., Chicago, Ill.
J. F. Smathern, Mgr. Ed. El. Co., Baraboo, Wis.
I. R. Shaw, Mgr. Ed. Ill. Co., York, Pa.
F. Sargeant, Mech. Eng. Chicago Co., Chicago, Ill.
E. V. Mattlock, of Leonard & Izard, Chicago, Ill.
W. H. Fairclow, Agt. Leonard & Izard, Chicago, Ill.
F. K. Hoover, director Ed. Ill. Co., Kansas City, Mo.
D. S. Orrison, director Ed. Ill. Co., Kansas City, Mo.
R. H. Horner, Ed. Ill. Co., Laramie, Wyoming.

After the meeting was called to order by Mr. Beggs, the president, the representatives of the New York, Philadelphia and Chicago companies made reports of the progress of construction on their large stations, and outlined in a general way what had been accomplished, stating also the times at which they expected the stations to be in working order.

Several important papers were presented and read before the association. The first was that of Mr. J. H. Vail, the Gen'l. Supt. of the Edison Electric Light Company. It was a valuable statistical document, giving a general review of the progress of the Edison business during the past 18 months. It showed an increase in central stations from 43 in April, 1886 to 148 at the present date, and an increase in capitalization of the stock companies from $2,750,000 to $11,500,000. Several remarkable load diagrams were shown. Among these was one that exhibited a maximum load of 9,000 ampères in one station. Diagrams were also presented from other stations, showing the growth of business in one year.

In one station the growth showed itself to be from an average of 1,030 ampères to an average of 2,100 ampères; in another station from an average of 1,300 ampères to an average of 2,700 ampères. A very striking feature brought out was the durability of dynamos. The records show that there are at present over 2,500 Edison dynamos of all sizes in use in central stations and isolated plants in the United States. The value of the dynamos employed in central stations is over $500,000. The cost of repairs on these dynamos has been less than $1\frac{7}{10}$ per cent. on the valuation. These records having been carefully compiled show that the life of an Edison dynamo, under normal conditions, will be at least 50 years, and they also prove conclusively that the depreciation is less and the durability far greater than is the case practically with any other class of machinery in the world. The paper in fact bristled with valuable statistical data on the various items of operating expenses and earnings of central stations, and gave comprehensive and digested information relating to the cost of labor, cost of coal, lamp renewals, and other elements entering into the operation of central stations, and of much interest and value, not only to the managers of local companies, but to all financially interested in electric lighting. Under the head of improvements it was shown that the Edison company and system has good reason to congratulate itself on the advances thus far made, and on those which the near future is likely to bring forth.

After this paper had received the careful attention it merited, note was taken of the loss sustained by the association in the death during the past six months of four leading members: Mr. J. W. Phillips, the late general manager of the company in Kansas City; Mr. H. E. Lincoln, late manager of the Edison Company of Brockton, Mass.; Mr. J. M. Marshall, the manager of the Edison Company at Grand Rapids, and Mr. T. W. Embree, the superintendent of the Edison Company at Westchester, Pa. The last named was a gentleman well known in Edison circles, and was a highly accomplished electrician, a careful student and a faithful worker. A committee of five, consisting of Messrs. Jenks, Markle, Vail, Weeks and Howell, were appointed to draft suitable resolutions on the death of these regretted members, the said resolutions to be printed in the minutes.

Mr. Jenks, Director of the Standardizing Bureau, and Manager of the Municipal Dept., read an exhaustive paper on incandescent lighting by high potentials. The paper began with defining *transmission* and *distribution* of energy, and found analogies throughout the field of engineering. It proceeded to show that in no case was energy at high potential allowed to come into untrained hands or domestic service, and argued that in electrical distribution, all the "retail" devices, such as distributing boxes, converters, and the like, which effected the transformation from "high" to "low" in close contiguity to the point of consumption were makeshifts whose unreliability and danger were becoming daily more apparent and admitted. Mr. Jenks then gave some figures as to the growth of the "municipal" system, or that in which incandescents are run in series on direct high potential for public lighting of various character, and he saw in the progress of the system evidence of its ultimate general popularity. Mr. Jenks brought to bear on his subject a vast amount of philosophical analysis and close investigation of the conditions to be dealt with. The paper was of profound interest, and won for the author warm words of praise.

Another paper was presented by Mr. R. M. Jones, manager of the Edison Company at Laramie. This paper gave evidence of an intelligent investigation into the distribution of electrical currents on the three-wire system, and contained some striking data as to the perfect regulation of the same. The discussion of this paper was one of the most animated of the convention, and was exceedingly interesting and valuable. It was generally felt that much credit was due to Mr. Jones for his careful presentation of the case.

Another paper which was of intense interest was that presented by Mr. Mottram, the superintendent of the Edison Company at New Orleans, giving, in a very vigorous and flat-footed manner, his opinion as to the operation and defects of the alternating system, supplementing his views by certain statements of facts which had come under his observation during the past six months. Mr. Mottram expressed himself convinced, by what he knew and had seen, that the Edison system had nothing to fear from the new departure. On the other hand, the increased demand for the Edison service had, under the special circumstances, convinced the people of the superiority of the Edison methods, and he believed the permanence of the Edison business in New Orleans to be established beyond all shadow of doubt.

Mr. S. Bergmann, of Bergmann & Co., made a very interesting address before the convention, showing a most gratifying advance and improvement in the various details of electrical apparatus and appliances for wiring buildings, and in electrical fixtures generally. Mr. Bergmann received hearty congratulations on the phenomenal success and growth of the business, and promised his attendance at the succeeding meetings of the association. Not the least interesting of his remarks were those which went to show how largely the electrical industry contributes to the export trade of the country.

Mr. E. H. Johnson, the president of the Edison Electric Light Company, delivered an interesting and important address on the general progress and standing of the patent suits. The association were highly gratified with the presentation made by Mr. Johnson as to the condition of affairs. Mr. Edison, departing from a rule to which this is believed to be the only exception, made a short address on some fundamental principles of the direct system of distribution as compared with the alternating or converter system. The relative economies of the two systems were critically compared, and what Mr. Edison deemed the inevitable deficiencies of the alternating system were pointed out. Mr. Edison went further and explained briefly such improvements in the direct system of distribution as would undoubtedly be brought forward in the near future at a fitting time. The association, by a rising vote, tendered to both Mr. Edison and Mr. Johnson their sincere thanks for their attendance at the convention and their active participation.

Following this came an important discussion on the subject of electric motive power. The growth of this business among the Edison stations during the past year has been exceedingly satisfactory. A pithy address to the point was made by Mr. H. McL. Harding, the manager of the Sprague Electric Railway and Motor Company, showing the diversified industries to which electric power has been successfully applied, and the rapidity with which the field has opened up. Some idea of the magnitude of the operations now engaged in may be formed from the fact that a large flouring mill company has been established at Laramie with its flour mill in operation, the power being furnished exclusively by Sprague motors, deriving current from the Edison station. A similar mill of somewhat less capacity has also been established at Scranton, Pa.

An interesting discussion was held on the merits of the meter system and the contract system of selling incandes-

cent lights. This subject has been under consideration from time to time at the meetings of the Edison Association, but it was considered that the testimony presented at this time was thoroughly conclusive as to the reliability of the meter, and as to the established financial success of companies working on the meter system, including therein the greater satisfaction which such companies gave to their consumers. This discussion touched, naturally, also upon the question of the distribution of current for power. After a thorough ventilation of this subject, a resolution was unanimously passed endorsing the Edison meter system. The resolution covered the accuracy of the meter, the tests which had been made of its reliability and the excellent financial condition of the companies which were using the meter.

A resolution was offered pertaining to fire insurance, and a committee was appointed to formulate the necessary data and information, with proper recommendations, to be presented at the next meeting of the association.

The above is the leading business transacted at this meeting, which those in attendance describe as being one of the most instructive and helpful of its kind. The convention was in session for two days, holding three meetings on Wednesday and two on Thursday. It adjourned to meet on the second Wednesday in August, at some suitable place within easy access of Boston, the exact location to be fixed by the Executive Committee.

The Incandescent Lamp Freak.

To the Editor of The Electrical World:

SIR: I was much interested in the description and illustration of the "Incandescent Lamp 'Freak,'" by G. W. Blodgett, in your issue of Jan. 21. I have been running a plant of 150 30 c. p. Bernstein lamps for the past year, using the Heisler series system. I notice that in nearly every case where the carbon gives out that the interior of the globe becomes blackened, as Mr. Blodgett describes, but I never met with a "freak" like that described. It does not seem to me that the softening of the glass could have taken place before the carbon was ruptured, even if the glass had a weak side, as the radiated heat through the vacuum of the simple filament would not, judging from my own observation, be sufficient to soften the glass in the least. Mr. Blodgett did not state how long the lamp had burned, for if it had been burning more than one night it would show conclusively that it could not have been done by the heat of the unbroken carbon. Sometimes, when the cutout magnet is slow to act the arc formed by a ruptured carbon holds for fully five minutes, giving off sufficient heat to explain this truly curious "freak." W. F. B.

MONTICELLO, Minn.

Winding Armatures and Polarity of Brushes.

To the Editor of The Electrical World:

SIR: Will you please inform me (1) if it is necessary, in winding an armature, that the last layer should be in the same direction as the first one. Suppose each bobbin for a Gramme ring is started from the left and wound to the right, and is four layers deep, the last layer will be from right to left, or should it be in the same direction as the first one? (2) Has the armature in the case to revolve against the movement of the hands of a clock? The upper field magnet is to be south, the lower one north.

PASSAIC, N. J. C. A. S.

ANSWER.—(1) The wire itself must be wound continuously in the same direction. It makes no difference what the relative direction of winding in each layer is, as it is evident that with an even number of layers the last layer will be wound in opposite direction relatively to the first. (2) If the upper pole piece is of "south" polarity and the armature, looked at from the pulley end, revolves in the direction of the hands of a clock, then the right hand brush will be "positive" and the left hand one "negative."—EDS. E. W.

Electricity and Rats.

To the Editor of The Electrical World:

SIR: Will a 50-cell gravity battery (the same as used by the Western Union Company) connected up in series give a current of sufficient strength to kill a rat or other small animal? If so, please describe some device which would accomplish the desired result? I had a plate of copper and one of zinc laid side by side, but insulated from each other. I connected the copper plate to battery and the zinc to ground, and arranged so that the rat would have to stand on the copper and zinc plates at the same time. This arrangement had no effect on them. Then I got a china saucer, laid it on the zinc plate, connected zinc to battery, filled china plate with milk and water, put a small copper plate in the saucer and connected it to ground. This had no effect either, the milk being drank up every morning—but no dead rat. EXPERIMENTER.

MILWAUKEE, Wis.

ANSWER.—Our correspondent is respectfully referred to the report of the New York State Commission on the execution of criminals by electricity. Anyhow, having gotten the rat so far as to drink out of the saucer, a little "Rough on Rats" would settle the whole business and prevent anxiety and waste of current, pending the refusal of the rat to die by electricity.—EDS. E. W.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
168-177 POTTER BUILDING, NEW YORK, Feb. 13, 1888.

Bucket Shops Raided.

A general raid was made on Feb. 11 on all bucket shops in New street, Broad street and lower Broadway. The proprietors or those conducting the business were taken away under arrest. There were no fewer than twenty-eight of the unfortunates subjected to this treatment, for whom bail was necessary.

Edison Measuring Instruments.

Not long since descriptions, with illustrations, were given in THE ELECTRICAL WORLD of measuring instruments used in the Edison system. I understand that these convenient instruments will be sold to the public generally. The sale will be in the hands of Mr. W. H. Meadowcroft, who is well known in the electrical field. It will be remembered that considerable ingenuity and pains were spent on the instruments in rendering them "standard;" in other words, in giving them a precision and accuracy that could always be depended upon. Not less trouble was taken to render them easily portable and readily comprehended as to operation and indication.

An Interesting Event.

On the fifth of this month, Mr. W. W. Marks, the reliable superintendent of the Bishop Gutta-Percha Company, completed 40 consecutive years in the preparation of gutta percha for the many uses to which this valuable product in that number of years has been applied. He can therefore justly claim the honor of being longer continuously employed in the insulation of wires for telegraph purposes than any man living either in this country or Europe. The knowledge and experience gained by Mr. Marks while manufacturing india rubber fabrics enabled him at the introduction of gutta percha into this country in 1847, after considerable experimenting, to design and furnish machinery which would make pipes, belting, bottles, frames and other articles. Soon after Mr. Bishop commenced, Mr. Marks was secured as superintendent, taking charge of the covering of wires for telegraph use, then an entirely new business.

This position he held until Mr. Bishop's death in 1872, when he became the sole manager of the only gutta percha works in America, holding this important place for thirteen years, or until the incorporation of the present company, when he resumed his former title. He has made many inventions, one called "Marks' Compound" being regarded as of the first merit as an insulation for wires to withstand the action of acids, etc., and it is sold in large quantities for battery copper connections. During the war he superintended the laying of the many cables made and laid for the Government and since has laid the majority of those made in this country, the last one being for the light-house buoy off Staten Island.

The high standard of excellence of the insulated wires and cables and goods in general as made and sold by the Bishop Gutta Percha Company is due to the careful attention and arduous exertions of Mr. Marks to produce the best by use of the most improved machinery, which he has constantly provided.

Waltham Non-Magnetic Watches.

Mr. J. R. Gleason, of the American Waltham Watch Company, at 5 Bond street, was recently interviewed as to their new non-magnetic watch, and the orders issued to railroad men to provide themselves with watches of that character. He said: "The new order is only a new one here in the East. In the West it has been in operation for some time. It was started by the Chicago & Northwestern Railway, and, being an absolute necessity, the other roads have had to adopt it one after the other. The reason that watches carried by railroad men are apt to be inaccurate is on account of the magnetic influence of the roadbed. The best of non-magnetic watches will be influenced by iron, so the reported inaccuracy of many of the watches examined by the inspectors merely shows that they are not adapted for the use to which they are put. The new Waltham watch, which was put on the market last month, is the first and only non-magnetic watch made in this country. The balance, hair-spring and escapement are made of a non-magnetic composition, which was discovered by us after many experiments. These watches will resist the most powerful magnetism, and will not stop or be in any way affected even when brought into actual contact with dynamos or other magnetic forces. The invention of this composition was not an accident, as so many of our most valuable inventions have been, but was really forced upon us by the advances of science. If there had been absolutely no necessity for such watches we would probably never have had any non-magnetic time-pieces. The real reason that brought about the perfecting of these watches was the employment of electricity in so many new ways, such as electric lights, tramways, motors, etc. So many watches were brought to us to be demagnetized by people who wore them where electricity was employed, that at last the question naturally suggested itself to us: 'Why not make a non-magnetic watch?' This, as I have said, we have just been able to perfect after long experimenting." W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
48 Congress Street, Boston, Feb. 13, 1888.

Personals.

Mr. Wm. F. Chester, for many years past identified with the district messenger service in this city, has been elected president of the Eastern Electric Service Company. His office is at 178 Devonshire street.

Mr. H. F. Watts, a prominent young electrician of this section and for some months past connected with the Somerville, Mass., Electric Light Company, has accepted a position with the Paris, Tex., Gas and Electric Light Company.

Telephone Matters.

Bell telephone is unchanged at 227. It is said that the company will spend about $3,000,000 the present year in long-distance lines, probably extending the system to Chicago. The present lines between Boston and Philadelphia cost $1,000,000. The statement that the Erie Telephone Company must put its wires underground in Cleveland at an expense of $150,000 is officially denied.

Winchester, Mass.

Advices from Winchester, Mass., report that a company will be organized in that town within two weeks for the purpose of furnishing electric lights.

Medford, Mass., Electric Light Company Incorporated.

The Medford, Mass., Electric Light Company has been incorporated. Its capital is $20,000. The officers are as follows: President, W. H. Warren; Treasurer, J. H. Hooper. The directors are: J. S. Sturtevant, W. C. Craig, H. C. Buck, F. S. Pearson, C. H. Loomis and the president and treasurer.

New Business of the American Company.

Mr. W. J. Morrison, Special Northern Agent of the American Electric Manufacturing Company, reports the recent installation of a 100 arc light plant of the American System at the works of the Halifax, N. S., Gas Company. It is stated that the American Electric Manufacturing Company has contracted with gentlemen in Yarmouth, N. S., for the early installation in that town of 26 arc lights at $2,000 per annum. This is a five years contract. Lights are to be in operation by April 1, 1888.

Improvements by the Palmer Company.

The electric light company at Palmer, Mass., are laying out the ground for a building 50 by 80 feet on the lot recently bought of Mr. Converse near the New London Northern Railroad's old depot, for a plant which will supply Palmer and Monson, and they hope to get some lights into Thorndike, Bondville and Three Rivers. Work will be pushed as rapidly as the weather will permit.

Electric Lights for Bucksport, Me.

Bucksport, Maine, now seems almost certain to have the electric light, arrangements now being in progress which will put it in there quite soon. Mr. George H. Grant, of Bar Harbor, has hired the old steam mill belonging to Edward Genn, and will put in a dynamo which will light the town thoroughly. It is thought that a large number of lights will be taken in the town.

Another Electric Light Enterprise.

A stock company is to be organized at Athol, Mass., to put in both arc and incandescent plants at a cost of $15,000, and it is arranged to take power from the cotton-factory dam. A few responsible individuals have taken half the stock and the other business men of the place are to be given a chance at the rest. It is believed that a sufficient number of arc lights to take the place of the street gas-lights can be put in and run for the price now paid for gas, and an informal canvass shows that there will be an immediate demand among large consumers for 600 or 700 incandescent lights out of the 1,000 which it is planned to furnish at first.

A New Electrical Manufacturing Company.

The Electric & Machine Company has fitted up very commodious quarters, for the manufacture of electrical apparatus and light machine work at No. 71 Sudbury street, Boston.

The company's facilities for turning out strictly first-class work is unsurpassed. Mr. P. C. Howe is superintendent. The extensive shops are fitted with a large variety of the latest and best improved machinery for turning out every known kind of electrical goods as well as model and pattern work.

Meeting of Feed Water Heater Manufacturers.

There will be a meeting of the leading manufacturers of feed water heaters at the Hoffman House, New York, Feb. 15 for the purpose of forming a manufacturer's association, having in view mutual protection and uniform prices.

Agency of the Shultz Belting Company.

The Boston *Commercial Bulletin* of Feb. 11 contains the following: Owing to the decease of Mr. Frank Pierce in November last a change was necessitated in the Boston agency of the Shultz Belting Company, St. Louis, Mo. The old office is retained, and Mr. W. P. Mullen, vice-president of the company, has assumed charge of affairs, and it is safe to say their interests at this point will be well cared for. Their products are shipped to France, Holland, and as far as Egypt.

An Electric Sharpener for Horseshoes.

Speaking about an invention he has made recently, Mr. Gardiner C. Sims, of the Armington & Sims Engine Company, says: "I am very fond of a good horse, and having one, do not let its shoes be taken off for sharpening. When the caulks become dull, I have them sharpened by filing. For some time, I have been experimenting with a combination, and in a day or so I hope to have it in perfect working order, and to demonstrate practically that the shoes of horses can be sharpened without taking off. I shall not patent it, nor make any claim of any kind. If I do not realize a dollar for it, I think no one would dispute my efforts or claim my improvements. You can readily understand that the expense of maintaining horses will be reduced. Their hoofs will be in better condition, as new nail holes need not be so numerous. The Society for the Prevention of Cruelty to Animals should indorse it, and the electric motor people ought to sell motors to every street car company in the country. The current can be taken from any circuit. One ½ h. p. motor at 25 cents per day will answer, and the outfit, excepting the motor, should not cost above $150, and can also be furnished by the motor people." Mr. Sims is a man of his word, and no visionary, and his invention will find its place.

The Institute of Technology.

The annual report of President Francis A. Walker to the corporation has just appeared. There has been an increase of 81 students the past year in the institute, of which number 63 were in the school of industrial science. The list of students represents 27 of the United States and two territories, Dakota and Washington, beside the District of Columbia. Among the foreign countries represented are Ireland, Canada, Peru, Brazil, Guatemala, Turkey, Japan and the West Indies. Of the total number of students in the school of industrial science, 429 are from Massachusetts, 98 from other New England States and 193 from outside. The number of women at present at the Institue is 25, of whom four are graduates of other colleges. The officers of instruction have been increased from 10 professors in 1865-66 to 13 professors, 6 associate professors, 9 assistant professors, 30

instructors and 17 assistants, a total of 75 this year. The president speaks of the generous bequest of the late Richard Perkins, of Boston, by whose will the institute received $100,000. In closing President Walker makes a statement in regard to the legislative petition for $200,000 and the state grant, first stating the purport of the petition. W. I. B.

PHILADELPHIA NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
39 South Tenth Street, Philadelphia, Pa., Feb. 13, 1888.

Mr. Thomas P. Conard,

who succeeded H. M. Sciple in the engine and boiler business at the northwest corner of Third and Arch streets, reports a good business for this season of the year. In the electrical light field he has placed a 60 h. p. Ball engine, and has under way other contracts which will call for several more of the Ball & Sciple "Electric" engines. The "Electric" engine, together with the upright boilers built by Mr. Conard's house, is particularly adapted for small plants, ranging in size from 3 to 20 h. p., and the claim is made for it that "it is beyond question the finest, most durable, reliable, economical and self-contained combined engine and boiler known for any and all purposes." Electricians speak very highly of it, and the numerous tests made confirm their high opinions. The boilers range from 4 feet in height and 24 inches in diameter to 10 feet in height and 48 inches diameter, and there are 12 square feet of heating surface to the horse-power. The weights range from 900 to 4,700 pounds, and of the fixtures 280 to 1,325 pounds.

Rawhide Gear Wheels.

Mr. H. Andres, of 22 North Fourth street, has on exhibition at his place a novel gear wheel, made of many pieces of hard rawhide, in layers compressed and cemented, the entire mass being held by iron flanges and bushing put in according to the exact size of the shaft. The particular claim made for these gear wheels is their noiselessness and durability, being far superior to steel or iron ones. One of them has been in constant use for six years as an experiment and shows no sign of wear. They can be made of any desired size or width, and while the first cost is slightly higher than that of steel or iron, they are more economical than others, to say nothing of the advantage of their being noiseless. The same material is also used quite extensively for the manufacture of small discs for upright spindles. Mr. Andres reports a splendid business in their oil tanned belting and lacing, the peculiar feature of which is that the hides are not limed, thereby avoiding disintegration of the fibre and the eating away of the gluten, which produces brittleness. Users of belting will at once see the advantages of the use of oil in tanning.

The Partz Battery Company.

The Partz Electric Battery Company expect to have ready for the market very soon a motor battery, which, with the small C. & C. motor, will be a boon to seamstresses and all operators of sewing machines, lathe workers, dental drills, and users of all light machinery. Two cells of this special battery have been in use for over six months in the company's office, and the results obtained have far exceeded their expectations. The motors will be made so as to be direct-connecting, thus making them convenient as well as compact. They report an unusually good demand for all of their batteries. The different styles are adapted to the uses of operating small motors, electro-plating, laboratory work, electric clocks, annunciators, and all medical and dental uses.

Harrison Safety Boilers.

The Harrison Safety Boiler Works have recently furnished a second boiler of 65 h. p. capacity, to the Haverford Electric Light Co. It, like its predecessor, is giving very satisfactory results. These boilers are, theoretically and practically, safe from destructive explosion even when carlessly handled, and, while this is the paramount requisite of any device, it is not the only point of merit. Economy of fuel, complete combustion and thorough absorption of heat, thorough circulation of water and heat, rapid generation of steam, durability and accessibility, facility of erection, ease of transportation and freedom of expansion, are among other advantages claimed and borne out by the results of severe tests made at the Centennial Exhibition, Franklin Institute Exhibition, Stevens Institute of Technology, the International Electrical Exhibition, and by Messrs. Cheney Brothers at their extensive silk works at South Manchester, Conn. Medals have been awarded the Company by the American Academy of Arts and Sciences, the Franklin Institute, and the London Exhibition of 1862.

Richmond, Va.

The Virginia Electric Light and Power Co. purchased recently the plant of the Schuyler Electric Light Co., and will, it is said, erect a plant corner Seventh and Canal street. Henry Steers, of New York, is president of the former company, and William M. Motley, Richmond, secretary and treasurer.

Shaw & Geary.

The two printing telegraph instruments of the International Printing Telegraph Company, mentioned in these notes last week, were made by the firm of Shaw & Geary, from drawings furnished, and are fair specimens of their class of work.

Additional Electric Lighting.

The city has, at a cost of $5,000, constructed underground conduits on the north side of Diamond street from Broad street to Fairmount Park entrance (Thirtieth street). Since the conduits have been laid Diamond street has been built up solidly from Fifteenth to Eighteenth street, and upon the south side of the street from Broad street to Twenty-third, with but about 200 feet of vacant space, and Director Stokley declares that the city has already been repaid a thousand fold for the small sum of money it has expended upon this thoroughfare. Diamond street is the main artery intersecting the city on the north, and it is the great outlet to Fairmount Park from Kensington and northern and eastern Philadelphia, which contains a population of 30,000 souls. An estimate has been prepared by Superintendent Walker, of the Electrical Department, for the placing of lamps, etc. The wire, sixteen iron poles, lamps (and power for one year) can be furnished for less than $3,000. The cost for maintenance after the first year will be so much per lamp, according to the contract made by the city. As a matter of police protection the electric lights upon this thoroughfare will prove of incalculable benefit.

Miscellaneous.

Mr. Boyer has introduced an ordinance in Common Council supplementary to that forbidding the breaking of streets between Dec. 1 and March 1, and allowing the "making or repairing of underground wire service connections with electric circuits for the purpose of introducing electric light or power into any dwelling or other building" between the above dates.

Select Council, at its last meeting, requested the Pennsylvania Railroad to place electric lights along Washington avenue from Third to Broad streets, a thoroughfare which is used exclusively by that company between the points named. E.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
44 Lakeside Building, Chicago, Feb. 11, 1888.

Wanted More Light.

The Normal Park Taxpayers' Association petitioned last week that a system of electric lights be established on Halsted street, from Sixty third to Sixty-ninth, and on Sixty ninth from Halsted street to Wentworth avenue.

Hillsboro, Ill.

At Springfield, Ill., the Secretary of State last week issued a license of incorporation to the Hillsboro Gas & Electric Light Company, of Hillsboro, Ill.; capital stock, $5,000; incorporators, W. C. Miller, John J. McLean and W. A. Howett.

A New Lighting Franchise.

The Hyde Park Trustees met last week and granted a franchise to the Citizens' Electric Light and Power Company of Kensington. The company proposes to furnish lights and power to the territory between Eighty-fifth and One Hundred and Thirty-eighth streets and Calumet Lake and State street, except the portion owned by the Pullman Company.

Topeka, Kan.

A correspondent writing from Topeka, Kan., sends the following;

On the 31st ult. the charter of The Oswego Electric Light Company was filed in the office of the Secretary of State. Capital stock, $60 000. Incorporators, F. L. Greene, C. D. Woodford, C. W. White, Hugh McNellis, C. B. Woodford, all of Oswego.

City Clerk Tauber has advertised for proposals for the construction and operation of an electric light plant for the use of the city. Sealed proposals will be received until Feb. 6, for the construction and operation of an electric light plant to run 120 electric arc lights, each of 2,000 candle power, with all the necessary equipments and appliances complete. All bidders are to state in their propositions what price per annum, for a period of two years from the time of starting the plant, they will guarantee the limit of entire cost of supplies, ordinary repairs and operating, based on the present price of fuel, labor and supplies, and conditional that the management of the entire plant shall be under the control or approval of the contractor. The foregoing is to be based on two plans, one for all night lighting every night in the year, and the other on what is known as the moonlight schedule, including nights when the moon is obscured by clouds or fog, lights to be kept burning until 2 A.M.

The contractor will be required to furnish a satisfactory bond protecting the city in the use and maintenance of its apparatus, and indemnifying it against any loss or damage or costs of suits or royalties on account of the infringements of patents in the purchase and use of the same. Several of the members of the city council have gone to Indianapolis to investigate the working of the Jenney electric light system in that city.

Personals.

Mr. E. M. Barton, president of the Western Electric Company, returned last Saturday from a ten weeks' business trip in the East.

Mr. C. K. Giles, of Giles Bros. & Co., manufacturers of Giles' anti-magnetic shield, returned last week from an extended trip in the interests of the firm.

Mr. Wm. Taylor, assistant manager of the Electrical Supply Company, was on the 9th inst. married to Miss Charlotte W. Dee, at St. Luke's Church, South Evanston, Ill.

The Edison Meeting.

The semi-annual meeting of the Edison Illuminating Association was held at the Grand Pacific Hotel last week, the 8th and 9th. Seventy delegates were present from all sections of the United States, being the largest number ever in attendance. The session were private, no one but members being admitted to the sessions. However, it was stated by all delegates interviewed that the meeting had been a very profitable one, and a large amount of business was transacted. Mr. T. A. Edison was in attendance.

The Western Electric Company.

The Western Electric Company are busy at their works. Among recent sales they report the following: 45 arc lights to Fort Benton, Montana; 25 arc lights to the Hoxton Steam Heating Co., Keewana, Ill.; 30 arc lights to Osceola, Florida, which have already been shipped.

The Fort Wayne Jenney Electric Light Company.

Mr. W. J. Buckley, manager of the Chicago branch of this company, informs me that the Lyons, Kan., Electric Light & Power Company last month formally started up its new plant of 30 arc lights, which is to furnish light for the city. The occasion was a merry one and was attended by a brass band and procession. He has just contracted with the same company to furnish them 400 incandescent lights. He also informs me that the installation of the large packing houses of Armour and Swift & Co., at Kansas City, Mo., with 600 incandescent lights each, has just been completed and that the purchasers are in every way satisfied and highly pleased. The Interstate Electric Company, of Kansas City, Mo., recently purchased a shunt-wound dynamo of this company for charging storage batteries made by the Electrical Accumulator Co., N. Y.

Central Electric Company.

The Central Electric Company, of Chicago, have accepted and placed upon that market a wire which, as a substitute for the ordinary painted wire, is a decided improvement. I refer to that manufactured by the Okonite Company, 13 Park Row, N. Y., known also as the "Candee" wire. While this wire costs a trifle more than the "underwriters," it is worth for ordinary purposes much more than the difference in cost. I understand that this wire is identical with that to be used in fitting up the United States Steamer "New Hampshire," for electric lights, the Okonite Company having received the contract for wiring that vessel.

New Use of the Electric Light.

The fifth annual banquet of the Chicago Real Estate Board was held at the Grand Pacific Hotel the 2d inst., and 225 covers were laid in the large banqueting hall. One of the local papers, in describing the table decorations, has the following: "The table decorations were of the most superb and eye-ravishing character. Each table had for its centre piece a jardinière of white and yellow roses, whose pure tints were offset by a hundred sprays of hyacinths and ferns innumerable. As for the long table, at which the speakers and prominent guests sat, it was enchantingly adorned. Miniature houses nestling amid a veritable forest of flowers, the houses moss-covered and glistening with atmospheric dew, and as if to surmount this climax and render the ornamentation yet more unique, from the parting centres of the roses shone, with captivating radiance, a tiny incandescent light, the battery that controlled it being hidden beneath the table. This is a new form of electrical apparatus, and this is its advent in the manner designated. The battery is technically known as the 'storage.' It is the invention of M. F. Gaulaguer."

Spokane Falls, Wash. Ty.

A recent issue of the Spokane Falls *Review* contains the following: The Edison system of incandescent lighting was put in the city by a local company a year ago last December with a small 300 light plant. The spring freshets disabled the water power used by the company for their dynamo, and for a time the light labored under a cloud. With the starting of an opposition company, now moribund, the local company was affiliated with the Edison Electric Light Co., of New York, and the capital stock, originally $20,000, was increased to $50,000, the parent company, of New York, taking control of the concern and making Spokane Falls what is known in electrical parlance as a "central station." Mr. H. M. Hoyt, one of our rising young citizens, was elected president of the company, and J. B. Fisken, an experienced and thorough electrician, superintendent. It is a curious coincidence, here to be remarked, that the entire management and control of the electric light plants and telephone system in Spokane Falls is in the hands of men under the age of 30 years. The new plant which is being put in, and which will be in operation ere this sketch is in the readers' hands, consists of six dynamo machines: four Edison, one American and one Brush, having a capacity of 1,800 incandescents and 53 arc lights. These dynamos will be driven by endless belts from a line of shafting the full breadth of the building. The pulleys used are "Hill's patent" friction clutch, which enables any of the dynamos to be started and stopped without affecting the others. There are two turbine wheels of about 300 horse-power each. Only one of these will be used and the other will be kept as a spare wheel.

The system, when first put in, was the old-fashioned "two-wire system," but it has now been changed to the "three-wire system." The building in which the new plant is situated is a most substantial one. The foundations for the wheel pits and penstocks are built of stone and cement. There is a separate penstock for each wheel. The ground floor of the building, which adjoins the C. & C. mills, is 45 feet square and is very complete in its appointments. When completed the plant will be the most perfect one in Washington Territory, and its capacity will be greater than any other. The work of construction has been under the supervision of Mr. Fisken, who has been ably assisted by Mr. Mitchell, of Mitchell, Sparling & Co., of Seattle.

The Electrical Construction Company.

The Electrical Construction Company tell me that they are now giving a good deal of attention to the getting out of specialties in the line of measuring instruments, galvanometers, ammeters, etc., for which they have employed special workmen. The galvanometer used by Dr. Whitfield in his lecture before the Chicago Electric Club last week to show the presence of an electric current between gold and amalgam when the two metals were placed under water was furnished by this company. As applied to dentistry the doctor is said to be the first to demonstrate this fact. E. L. P.

ENGLISH NOTES.

LONDON, Jan. 25, 1888.

Domestic Electric Lighting.

The House to House Electric Light Supply Company must at least be credited with a competent knowledge of the important art of advertising. Three weeks ago advertisements appeared in almost all the London papers announcing that this company were prepared to undertake the supply of electricity from central stations "on the meter system." They have now followed this up with a statement, to which equal publicity has been given, that applications for the establishment of central stations have already been received from 35 districts of London and the suburbs, and 27 towns in the provinces. "Householders in these districts should send in their applications at once to the secretary." We are also informed that "central stations, at an early date, will be put down in proximity to every good district in London and in the suburbs." At present this company have, however, only two stations in actual operation, one at Brighton, to which I have alluded elsewhere in these notes, and which has been described in great detail by your contemporary, the *Electrician*, and the other at the neighboring town of Eastbourne.

Alternating Current Stations.

The Brighton Station at present comprises 1,500 lamps, and is worked upon the multiple-series system, but it is at the present moment undergoing transformation into an alternating current system. The latter system has already been for some time at work at Eastbourne. Though I have not yet had an opportunity of visiting this latter station, there appears to be no room to doubt that the company has made a distinct success. The alternating current machines were built by Elwell-Parker, and have radial field magnets pointing inwards, like the Westing-

house, but the armature wire is wound around the core like a Gramme ring, instead of being laid upon the exterior, as in the latter machine. The transformers are known as the Lowrie-Hall type. This transformer is of a type easily and cheaply made, but it has the disadvantage of requiring a somewhat long magnetic circuit. The most interesting feature of the Eastbourne installation is undoubtedly the meter. Messrs. Lowrie & Hall have succeeded in producing an alternating current meter in the form of an electrolytic cell in which copper is deposited, and the plates are weighed from time to time just as in the ordinary meter of the Edison type. The meter is placed directly in the main circuit of the secondary coil of the transformer and takes the whole current. I am unable at present to explain upon what principle this meter acts. It would not be difficult to understand the evolution of gas by an alternating current in which the gases would be given off alternately from either electrode, but the actual transformation and deposition of metal upon one electrode by means of an alternating current, is by no means easy to explain.

Lighting the City.

I understand that the Anglo-American Brush Company has now come to terms with the city commissioners, and has accepted their proposal for the deposit of caution money, so that the work will probably be proceeded with at once. This involves the erection and supply of over 600 arc lamps, which will be placed in Queen Victoria street, Cannon street, St. Paul's Church Yard, Fleet street, New Bridge street, and Blackfriars Bridge.

Lighting at Kensington Court.

Messrs. R. E. Crompton & Co. have a small central station at work at Kensington Court. At present, about only 300 lamps are supplied, but negotiations are in progress which are expected to result in very considerable extensions. The plant at present in use is equal to a load of 4,000 lamps, and consists of two Willans vertical engines coupled direct to Crompton's compound wound dynamos delivering current at 100 volts. There are also three sets of storage cells of the Howell type. This cell is made of lead, which is cast by some process which produces a porous mass like pumice-stone. Mr. Crompton tells me that they are giving great satisfaction, and that he intends to largely increase the number in use. The distribution is in simple parallel. The mains are all laid underground, and several different kinds of conduit are employed, according to the nature of the ground traversed. Along one portion of the route the mains consist of a bare copper rod of square cross section. They are supported by insulators, and inclosed in a cement conduit. This conduit is drained at frequent intervals, and no special precautions are taken to make it watertight. The results have proved highly satisfactory. Callender's bitumen conduits are also in use; both iron and lead pipes are employed. It is perhaps worthy of note that the illuminating power of the lamps does not in the great majority of cases exceed 12 candles, which for domestic purposes is found amply sufficient. The district of Kensington contains a large number of wealthy residents, and the only disadvantage from an electric lighting point of view is that so many of the houses are shut up during several months of the year.

Harmonics and "Dynamicables."

The meeting of the Electro-Harmonic Society, which takes place at St. James' Hall, on Friday next, will be preceded by a dinner of the "Dynamicables." I do not know whether the fame of this latter institution has reached your side of the water, but if not, I would have you to know that the Club of the Dynamicables was founded about three years ago with the object and purpose of meeting once a month, first, to dine, and, secondly, to discuss matters of technical import. It gradually came to pass, however, that the latter object fell into abeyance, and the Dynamicables are now content with the festal portion of the programme, and usually leave the interests of electrical science to look after themselves. The idea of holding the dinner at the same place and on the same evening as the concerts of the Harmonic Society, although an innovation, is certainly a very happy one.

A New Crompton Dynamo.

Turning, with reluctance, from these festivities to more weighty matters once more, I may inform you that Messrs. Crompton & Co. are bringing out a new type of dynamo, involving several points of interest. In the first place, the armature wires are threaded through holes stamped in the margin of the core, so that the wire is entirely enclosed by iron, and the air space is reduced to the mechanical clearance. They also make use of what they call reversing poles. These poles come opposite a coil which is under the brush, and the object is to assist in the reversal of the direction of the current by counteracting the self-induction of the coil. I have not yet had an opportunity of examining the new machine, but I understand that a remarkably good performance is claimed. While writing of this firm, I may add that I hope soon to send you some account of the performance of the 500,000-watt Crompton dynamo, which has been built for the Cowles process. The machine has been finished some weeks, but the engines are not yet ready.

The Delany Multiplex.

At the Central Telegraph Office to-day in St. Martins-le-Grand I saw the Delany instrument in operation. The officials express themselves as remarkably well pleased with its performance. A good many more circuits will shortly be worked by it, and one of the Bristol lines is just in process of being fitted. In this as in the other cases at present in use, the six instruments are all placed in the same terminal office. At Leeds, however, a repeater has been successfully introduced, and London now speaks through to Edinburgh on a Delany circuit with a repeater at Leeds. In the hands of the Government officials in this country the apparatus has undergone considerable modifications in detail, although the fundamental principle remains entirely unchanged.

Edison-Swan Low Resistance Lamps.

The Edison-Swan Company have lately turned their attention to the manufacture of lamps of low resistance and high candle-power. This matter has been forced upon them by the success of the "Sunbeam" lamps made by Messrs. Clarke, Chapman, Parsons & Co., of Newcastle-on-Tyne. Hitherto the difficulty with these lamps has arisen from the rapid blackening of the surface of the glass; in some cases a new lamp will in less than an hour's use become covered with a dense deposit, while other samples of the same lamp may be run for 300 or 400 hours with scarcely a perceptible change. As the lamps are sold at thirty shillings a piece, it is evident that this difficulty will have to be overcome before any great demand will arise. The lamps are of course intended to be run in series.

Rates for Electric Lighting.

The House to House Company propose to charge at the rate of one shilling per thousand watt-hours or Board of Trade unit as we call it. This must be considered a somewhat high rate, the average price in this country being 8d. or 9d. a unit, which may roughly be taken as an equivalent to a charge of one dollar per thousand cubic feet of gas. However, if the new company can get customers at one shilling, so much the better.

Mr. W. Siemens on Series Incandescents.

In a paper recently read by Mr. William Siemens, of Berlin, it is stated that the firm of Siemens & Halske had for some years been giving their attention to the manufacture of a lamp suited for series running. It is pointed out in this paper (though the observation, by the way, is originally due to Mordey) that while the gradual increase of resistance in an incandescent lamp upon a constant potential circuit tends to prolong its life though decreasing its candle-power, yet on a constant current circuit an increase of resistance means an increase of candle-power, a greater consumption of energy and a correspondingly shorter life. This is the particular point to which Messrs. Siemens & Halske have long been devoting their attention, and as they say with considerable success. I am not aware whether or not the English firm are giving special attention to this point, but it is obviously one of great importance.

THE TELEGRAPH.

Taking Up Mutual Union Bonds.—The Western Union Company is now printing $5,000,000 of its new consolidated mortgage 5 per cent. bonds, to take up the outstanding Mutual Union bonds, according to the plan heretofore outlined.

Obnoxious Private Wires.—Owing to the newspaper agitation over the fact that stockbrokers' wires run direct into the national capitol building at Washington, on the House side, Speaker Carlisle has ordered all such wires to be removed, leaving only the regular telegraph service.

Western Union Earnings.—The *Daily Indicator* reports that the largest holder of Western Union stock states positively that the next dividend will be at the rate of 6 per cent. per annum. The test offices of the Western Union Company this week show receipts of $193,500, an increase in seven days of $34,400.

Kansas City, Mo.—The Home Telegraph Company filed its articles of incorporation recently. Its stock of $100,000 is held equally by Thomas E. Gaines, Charles E. Kearney, P. H. Madden, Frank P. Perrin and John W. Spears, all of Kansas City. The object of the incorporation is to own and operate telephone and telegraph systems and to establish, maintain, operate and lease a system of communicating by messengers, messages and signals by means of such systems.

The B. & O. Transfer.—At the regular monthly meeting of the directors, a working contract, executed on the part of the Baltimore & Ohio Railroad Company by President Spencer with the Western Union Telegraph Company, under the terms of the sale of the Baltimore & Ohio Telegraph Company, made on Oct. 5, 1887, was approved. The contract provides for the leasing of the Western Union Telegraph Company of a number of wires along the line of the Baltimore & Ohio system, which are not needed for the transaction of the railroad business of the latter, and for which the railroad company will receive $60,000. The contract also guarantees and defines the rights and privileges of the Baltimore & Ohio Railroad Company and the Western Union Telegraph Company in reference to all telegraph affairs, and provides for the employment of a superintendent who shall have charge of all the business growing out of what are now the railroad wires of the Baltimore & Ohio Company and those of its commercial system, which belong to the Western Union. It is expected that Charles Selden, who has been attending to both systems since the sale in October, and was general superintendent for the Baltimore & Ohio Telegraph Company, will be continued as the joint manager.

THE TELEPHONE.

Virginia.—A bill is before the Virginia Legislature to incorporate the Falls Church Telephone Company.

Boque Chitto, Miss.—It is stated that the Keystone Lumber and Improvement Company will build a telephone line 7½ miles long, and wishes to purchase telephones, wires, supplies, etc.

Six Dollars per Month.—At Albany, on Feb. 8, in the House of Assembly, Mr. Finn introduced a bill to make the charges of telephone companies in New York and Brooklyn $6 per month for each telephone.

Hutchinson, Kan.—A suit for infringement has been brought by the American Bell Telephone Company against the Hutchinson Water, Light and Telephone Company, which has an exchange using the Cushman telephone.

Spokane Falls, Wash. Ty.—The Telephone Exchange at Spokane Falls, put in in December, 1886, now has 125 subscribers. The city is the centre now of 400 miles of territory traversed by telephone wires. Mr. W. S. Norman is the secretary of the company.

Nova Scotia.—The Halifax, N. S., *Chronicle* says: The Nova Scotia Telephone Company has formally taken possession of the property and business of the Bell Telephone Company, and the connections with the trunk lines leading to different parts of the province has been effected. The toll rates from Truro and places beyond will be 25 cents for a conversation of five minutes. A toll for the shorter circuits has not yet been fixed; it will probably be 15 cents. The central office system of the two companies are somewhat different. The Bell system will be continued for the present, but, as it is claimed the other company's is the most satisfactory, it may be substituted later on. Mr. A. A. Knudson, superintendent of the Nova Scotia company, takes charge of the affairs, Mr. Edwards retaining his present position and the staff of employés remaining the same.

THE ELECTRIC LIGHT.

La Junta, Col., is to have an electric light plant.

Tampa, Fla.—The Tampa Electric Light Company will enlarge its plant.

Sheffield, Ala.—The city lighting contract goes to the Sheffield Electric Light Company.

Tallahassee, Fla.—The Tallahassee Gas and Electric Light Company has been incorporated.

Parkersburg, Va.—The contract for lighting Parkersburg has been secured by the Fort Wayne Jenney Company.

Jackson, Mich.—The Jackson Electric Works have been incorporated by A. N. Foote with a capital stock of $75,000.

Laredo, Tex.—The Laredo Electric Light Company has G. Sackett, E. M. Johnson and J. M. Clark as its officers. Its capital stock is $50,000.

Red Bluff, Col.—The Red Bluff Electric Light Company has been incorporated by N. P. Chipman and others with a capital stock of $25,000.

Mount Vernon, O.—The Mount Vernon Electric Light and Power Company, incorporated recently by C. Cooper and others, has a capital stock of $10,000.

The Orient Company.—The Orient Illuminating Company is a recent incorporation in Maine, by W. J. Robinson and others, with a capital stock of $100,000.

Cartersville, Ga.—The Cartersville Land Company, incorporated by J. W. Akin and others with a capital stock of $10,000, has electric lighting privileges.

Raleigh, N. C.—The Raleigh Lighting, Heating and Power Company, organized by parties interested in the local gas company, has a capital stock of $25,000 and will put in an electric light plant.

Little Rock, Ark.—The Citizens' Incandescent Electric Light Company has been incorporated by M. Pollock, president; A. Hamberg, P. E. Brugman, L. L. Mivelaz and J. Calef, with a capital stock of $500,000.

Gainesville, Ga.—The Gainesville Light Company has been formed by A. D. Chandler, J. A. Smith, J. W. Bailey, C. C. Sanders and others to build gas works, electric light plant, etc., with a capital stock of $20,000.

Clarksburg, W. Va.—Mr. W. F. Richards and C. M. Hart hold a controlling interest in the Clarksburg Electric Light Company. The plant is to run 800 lights, averaging 30 c. p., and probably water power will be used.

Birmingham, Ala.—The Birmingham Edison Electric Illuminating Company will hold a meeting on March 1 to discuss the increase of stock from $75,000 to $100,000, the issuance of not more than $30,000 of bonds, and the increase of the plant.

National Electric Light Association.—The regular annual meeting of the National Electric Light Association begins at the Monongahela House, Pittsburgh, Pa., on Feb. 21, and promises to be one of the most important conventions ever held by the Association.

The American Watch Tool Company last fall introduced incandescent electric lighting into their factory. The result is, for the present, a slightly increased cost of light, but greatly increased purity of air, and noticeable improvement in the quantity of work and in health of workmen. There is not one breakage of a lamp.

A Paris Theatre.—The Paris Ambigu Comique has discarded gas and utilized the electric light. It is the only theatre in France where not a single jet of gas is burned. The experiment was first made of lighting the auditorium with electricity, and this proved so successful that the innovation has now been extended to the stage.

Philadelphia.—The Edison Electric Light Company, Philadelphia, has decided to use the well known Abendroth & Root safety boiler. The Abendroth & Root Manufacturing Company, New York, is now at work upon the first portion, 850-horse power; the others to follow as soon as buildings can be prepared. The total will be 3,450 h. p. of boiler capacity.

Leicester, Mass.—An electric light company has been formed at Leicester for lighting the streets and different manufacturing concerns in the town. E. L. Watson, of the firm of L. S. Watson & Son, is president; W. J. Whittemore, of the firm of W. & J. Whittemore, is treasurer, and Harry Sargent, president of the Leicester Wire Company, is manager. It has put in the Thomson-Houston system of electric lights, which gives much satisfaction.—*Boston Jour. Com.*

Baldwin Locomotive Works.—The Baldwin Works have lately been equipped with the Westinghouse alternating system of electric lighting, and the officers are highly pleased with the results attained. As a great deal of work is being done at night, and as mechanical operations require good light, the system is receiving a severe test, but it is said successfully, to meet all requirements. There are 2,700 incandescent lights throughout the works. Exceptionally small power appears to be needed for keeping up the supply, and the lamps give no trouble whatever.—*Iron Age.*

The Mayo System.—Clark Bros., of Belmont, N. Y., the manufacturers of the Mayo system, write: "We have lately installed one of our Mayo incandescent plants of 75 lights for Blaisdell Bros., manufacturers of kindling wood, Carrollton, N. Y., and one of 85 lights for the Scranton, Pa., Packing Company. The latter plant runs 24 hours per day, seven days a week. The armature temperature is never more than 28 degrees higher than that of the surrounding air. We have been testing the Mayo motor lately, and find that we can guarantee an efficiency of 88 per cent. on the 5 h. p. motor on 110 volt circuit."

Medford, Mass.—There is considerable hard feeling between the selectmen of Medford and the Electric Light Company, of Malden. At a town meeting recently held in Medford, the town voted to instruct the selectmen to establish 15 electric lights in various sections of the town, to be used until June 1, and appropriated $300 for that purpose. The selectmen sent for Mr. Bliss, superintendent of the company and told him to place 15 lights in the town, designating the location for the lights. The

electric light company began running its wires and placing the poles, and had gone to considerable expense, when it was notified by the selectmen that, as the company was organized under the laws of the State of Maine, they had no authority to make a contract with it, and that they rescinded their vote. The company still continued the work of running the wires and placing the electric light poles, until it was stopped by Chief of Police Holmes, he receiving orders from the selectmen. The selectmen stated that they had given the order to the Medford Electric Light Company, but the name of no such company appears on the books at the State House, and the officials of the Electric Light Company of Malden say that there is no such company in existence.

Electric Lighting in India.—The electrical engineer in charge of a Gulcher plant at Benares says: A good deal of valuable awe attached to me as the sahib who controlled and had in subjection this mysterious force and its appliances, and a dimmer halo surrounded the heads of my men in the eyes of their countrymen. Coming into the machine room at night I would often find the little Mohammedan lad, Ghazi, who had charge of the dynamo bearings and brusnes, the centre of a crowd of wealthy Mahajans and Babus from the city, who would be humbly questioning him as to the wonderful properties of the machine, and he arrogantly giving some fearful theory of his own as gospel, and pocketing annas for magnetizing their knives on the magnet poles.

APPLICATIONS OF POWER.

Easton, Pa.—A farmer took a ride recently on the Daft electric road at Easton, Pa., for the cure of his rheumatism. His opinion after the trip was that he had derived no benefit.

In a Chicago Printing Office.—A Baxter motor has been put into service in the printing office of Kittredge & Friott, Market street, Chicago, where it is doing good work on the arc circuit of the Chicago Arc Light and Power Company.

St. Louis, Mo.—A special dispatch from St. Louis, of Feb. 11, says: After many months spent in experimenting with and investigating motors for street railways the Lindell Railroad Company, using Washington avenue and other streets in this city, yesterday finally adopted electricity as the motive power for their road. The motor adopted is a combination of the Julien storage battery and the Brush motor. One car has been in constant operation during the week and has given entire satisfaction, and the whole equipment of the road will be fitted out with the motor as soon as the necessary work can be done.

Electric Fire Engines.—Writing to the New York *Times*, "C. J. B." says: "You should have completed your suggestion concerning electric fire engines by showing that such a machine with an electro-motor operating a pump would probably not weigh a third as much as the present pondrous steam engine, and that if a current of water may be distributed about the city from a central station a current of electricity may also be, and in case of fire, while the pumps are being attached to the hydrants the engineer may be attaching the connections of his motor to the proper wires, and the alarm having notified the central station, the electric current therefrom would operate the fire engine, entirely avoiding the transport of heavy accumulators either on the engine or hose carriage. The great advantage would be in the lighter weight of the engine, and hence the greater speed and ease with which it could be taken to a fire."

Dinner Table Motors.—We British are fond of having a number of servants in attendance when we dine. Flunkeys with us are supposed to have ears that hear not, and eyes that see not, what their employers say and do. It would be impossible to suppose anything of the sort in Paris. Masters and mistresses dread the criticisms of the servants' hall, and their highest idea of dining-room comfort is to be served by machinery. The dinner-lift came into fashion in the reign of Louis XV. Electricity is now being used to enable persons of wealth at *dîners intimes* to do without the waiter or the *maitre d'hôtel*. A miniature railway is laid down on the dinner-table and continued on the same level into the kitchen through an aperture in the wall and an intermediate pantry. Dishes come in and after making the round of the table, go out on a sort of small truck moved by electricity. The truck at any moment can be made to stop. It does its work admirably as a dumb-waiter, and any amount of art can be lavished on it to give it a decorative beauty.—*London Truth.*

Philadelphia, Pa.—The Rapid Transit Electric Railroad Company, which was incorporated at Harrisburg on Feb. 7, intends to introduce in Philadelphia a system of electric railroads for the transportation of the public from the centre of the city to the extreme northwestern portion. The corporators and stockholders in the new company are: Hiram Miller, Nathaniel E. Janney, William A. Levering, C. N. Apple, S. P. M. Tasker, Lewis Eckel, Samuel A. Newman, Franklin Noble, J. B. Mencke, Crawford Spear and Theodore K. Vogel. The route contemplated will begin at Twenty-ninth and Allegheny avenue and move southward on Twenty-ninth street to Ridge avenue, to Twenty-eighth, to Parrish, to Corinthian avenue, to Brown, to Marshall, to Wood, to Sixth, to Minor, to Fifth, to Wood, to Seventh, to Spring Garden, to Eleventh, to Poplar, to Twenty-ninth, to the place of beginning. In addition to the ordinary cars, seating twenty persons, this line will run during the morning and evening hours double-length cars, with seating capacity for fifty, thereby meeting the extra travel at those periods of the day.

PERSONALS.

Mr. Alfred Dolge, the proprietor of the great felt works at Dolgeville, delivered on Jan. 28 his annual address to the employés, reviewing the progress of the year. Mr. Dolge has worked out carefully a plan of profit sharing and the aid society, pension fund and life insurance policy of the factory have received the attention of the American Society of Social Science. As our readers are aware, part of the great growth at Dolgeville is due to the demands of the electrical trade.

Mr. Eugene F. O'Connor, the president of the Telegraphers' Mutual Aid and Literary Association, of Boston, was, it will be remembered a leader in the great strike of 1883. After the strike he entered the Baltimore & Ohio service, and he is now on the editorial staff of the Boston *Globe*, which says of him: "Mr. O'Connor's activities have not been confined to the sphere of his profession. For the last two years he has been first assistant assessor of the city of Boston and by his level head, his cool judgment and his business sense has rendered himself invaluable to the taxpayers, as well as the board of assessors. Although a stanch Democrat—just as all good citizens are at heart—he has countless friends among the Republicans."

MISCELLANEOUS NOTES.

Morristown, Tenn.—The Morristown Alarm Company has been incorporated by O. C. King and others, with a capital stock of $20,000.

Electric Gates.—The Knight Electric Gate Company has been incorporated at Alexandria, Va., with a capital stock of $1,500,000, by T. A. Mitchell and others.

Beattie Zincs.—The Beattie Zinc Works, of Fall River, Mass., are making 90,000 "crowfoot" zincs for the Western Union Telegraph Company, and want 100 tons of material to fill the contract.

Sea Signals.—The proposition made by the New York Maritime Exchange for an international conference to devise means of diminishing dangers at sea by an improved system of signaling suitable for fast steam travel is being favorably received.

Cleveland, O.—The commission on underground wires at Cleveland, O., recommends that within a year telephone, telegraph and electric light companies place a part of their wires underground. The estimated extra expense to the Erie Telephone Company is $150,000.

Fatal Accident at Buffalo, N. Y.—A broken telephone wire fell across an electric light wire at Buffalo on Feb. 4. It came in contact with a horse, which was killed at once. A colored porter passing took hold of the wire to pull it out of the way, but received a severe shock and died before he could be removed to the hospital. As the city has failed to enforce its ordinance about putting the wires underground, it is said that the friends of the porter will bring suit against the city for damages.

Kansas City, Mo.—The articles of incorporation of the Kansas City Electrical Company have been filed. The capital stock is placed at $10,000 and is divided into 100 shares. The stockholders and incorporators, each of whom has twenty shares, are E. L. Martin, George M. Meyers, W. H. Woodring, Charles E. Kerney and Watson J. Ferry. It is stated that the corporation has been formed for the purpose of manufacturing, purchasing and selling electrical instruments and supplies of all kinds and doing all kinds of work in which electrical apparatus can be used.

Greetings from Australia.—We are in receipt of a very handsome large card of Christmas greetings from the officers at the Central Electric Telegraph office, Melbourne, Victoria. The card is blue gilt, three-folded, and contains views of Melbourne in 1839 and 1887, as well as of other places in the colony, sketched off insulators. Outside is a neat portrait of Mr. T. R. James, the manager, and inside are the miniature cards of all the members of the staff. Mr. O. Dobson is the artist, and is to be warmly congratulated on his skill and originality of design.

Meeting of the New York Electrical Society.—At the last meeting of the above named society, held in Clinton Hall, Mr. C. S. Bradley gave an interesting lecture on the fundamental principles of the electrical units. By the aid of a Thomson reflecting galvanometer and a calcium light as a source of illumination, Mr. Bradley was enabled to exhibit before his audience the spot of light traveling over a large scale. By means of a standard ohm and standard cell the speaker illustrated the principle of the fall of potential, current, etc. The discussion was participated in by Dr. Van der Weyde, Mr. Mailloux, Mr Crocker and others.

BUSINESS NOTICES.

We publish below classified notes of a large number of the leading concerns in the steam engineering and mechanical industries that make a specialty of catering to the electric lighting trade in its various branches. The items not only contain a large amount of interesting information, but will be found valuable as a guide to the purchase of goods from reliable companies and firms.

ENGINES.

The Fishkill Corliss Engine, manufactured by the Fishkill Landing Machine Company, Fishkill-on-the-Hudson, N. Y., has recently come prominently before the public as an electric plant engine, by virtue of late improvements (patented) which place it among the high-class engines in point of economy. Any improvement that adds to the economical working qualities of an engine has heretofore been encouraged by electric light engineers, and this now calls for their attention.

Westinghouse Engines.—The Westinghouse Machine Company, Pittsburgh, report the most active demand for their engines, both the "Standard" and the "Junior." For the Westinghouse engines the point is made that the full power of the engine and of the fuel consumed are available for producing currents, by reason of the high initial speed of the engine, which permits of belting direct to the work, and avoids the loss incurred in "speeding up" devices. Westinghouse engines are now in use everywhere, and the demand, large before, is greater than ever.

A. C. Manning & Co., 18 Vesey street, report that their business with the Otto gas engine for all electrical purposes is greatly on the increase, and that from the wideness of the field of electrical work they see no end to its adaptability and utility there. Next to its general introduction by gas companies for lighting the smaller cities, its field will be for the smaller engines, in isolated plants for private houses, etc. They are particularly pleased with the results obtained from the application to storage batteries, in which case the expense of an engineer is eliminated and there are the advantages of small space, light insurance and safe flues.

The Williams Engine.—Speaking of his engine, Mr. S. T. Williams, of 167 North street, Baltimore, says: "We have a small shop with good tools and efficient workmen, and build a few engines at a time. These engines are built under my direct supervision. We are busy now building a number of 8 h. p. vertical engines, and expect to have them ready for the market in a short while. We shall endeavor to keep a stock on hand. We are studying the requirements of electric lighting especially, knowing that if our engine can perform that class of work satisfactorily it can do any other work under the sun."

Otto Gas Engines.—The active share which gas companies are taking in electric lighting augurs well for the increasing adaptation of gas power to this work, as gas companies cannot have better economy in producing power than by using the gas at the cost in the holder. This new departure found a thorough test and beginning at Spencer, Mass., Nashua, N. H., and Washington, Ind., and Schleicher, Schumm & Co., the representatives of the Otto gas engine, are now preparing patterns for the largest sizes for such work. For isolated plants, mostly incandescent, they now frequently have orders for from 10 to 25 h. p., and the demand is greater than ever before. The firm are quite confident that electric lighting by gas engines will soon be a very general thing in large residences, club-houses, etc.

Rice Automatic Engines.—The John T. Noye Manufacturing Company, of Buffalo, N. Y., are furnishing and erecting the entire steam power plant for the United States Electric Light and Power Company of Buffalo. The engine is a 300 h. p. pair compound condensing engine, of the Rice automatic pattern, arranged so that in case of accident either engine may be operated with live steam and the other disconnected. The preparations are made for 1,000 arc lights. The company have also been given the order for one 300 h. p. and two 100 h. p. pair compound non-condensing Rice automatic engines for the Thomson-Houston Electric Light and Power Company of Buffalo, and two Rice engines, 16 × 16, of 160 h. p. each, intended for the Thomson-Houston Electric Light Company of North New York, are ready for shipment.

The Beck Engine.—The Taylor Manufacturing Company, of Chambersburg, Pa., report an active demand for their steam engines and boilers in the electrical field. They have recently installed one of their 9½ × 12 50 h. p. Beck automatic engines in an Edison isolated plant owned by the *Leader* Publishing Company, Pittsburgh, Pa., which, besides running the dynamo, also furnishes power for the presses. The *Leader* people are highly delighted with the operation of the engine, and will take pleasure in exhibiting it to any who may call during the Electric Light Convention. They have recently sold and delivered, through the Marr Construction Company, of Pittsburgh, Pa., to the Edison Electric Light Company, of Grand Rapids, three Beck engines, each of 150 h. p., 15 × 18 cylinder. They have quite a number of other orders booked for the Beck automatic, principally for electric light service, and their prospects for the ensuing year are for largely increased sales.

BOILERS, ETC.

Lidgerwood Boilers.—The Lidgerwood Manufacturing Company, 96 Liberty street, New York, manufacture, in connection with their standard hoisting engines, a superior quality of boiler, both as regards materials and workmanship, which has proved eminently satisfactory for electric light purposes. They have lately erected a new boiler shop to enable them to keep up with the increased demand for their boilers, which bid fair to rival their famous hoisting engines in popularity. All this company's goods are "standards" in the line.

The National Water Tube Boiler Co., have just completed the erection of 200 h. p. of their water tube boilers, in the new Hazeltine Buildings, Fifteenth and Chestnut streets, Philadelphia, Pa. These boilers are to be used for power and heating purposes, and were selected, after a sharp competition, on account of their many well-known good qualities, it being necessary to have those that were safe from disastrous explosions, as well as economical in all respects. They were fitted with the Standard rocking grate bars, in both furnaces, which will insure the greatest possible economy in the use of fuel. Information in regard to both boilers and bars may be had by addressing the above company, at New Brunswick, N. J.

Locke Damper Regulator.—One of New England's growing manufactures is the quiet but thrifty business carried on by the concern of Locke Bros., at Salem, Mass. Here is made, among other steam appliances, the well-known "Locke" damper regulator and gauge tester. This is a most ingenious device for regulating at once any number of the heaviest dampers to such a nicety that the fires in large steam plants, such as those of electric light stations, can be kept at just the point required to keep even steam pressure in the boilers. This exactness and constancy of fire prevents the gross waste which always results from continued spasmodic firing up and slowing down. A corresponding constancy of steam pressure is thus obtained, and of this constancy all engineers know the great value. Such is the construction of the Locke regulator that it is extremely sensitive, and this without loss of power to move immense dampers. It is now in use in five hundred of the most prominent steam plants, among which are many of the largest electric light stations. The firm's offer of $1,000 in our advertising columns is worthy notice.

PULLEYS, SHAFTING, ETC.

Hill Clutch Works.—The West Side Power Company of Minneapolis have accepted their plant—which is one of the largest and most thoroughly equipped of its kind in the country—after a running trial of 60 days. This plant was designed, erected and furnished complete by the Hill Clutch Works, of Cleveland, Ohio. The plant put in for the Excelsior Electric Company, of Port Huron, Mich., has also been recently accepted as entirely satisfactory, on a full running test. One of the new features in the manufacture for Hill "A" clutches of large size is the making of them with six arms instead of four, which gives a much greater capacity for the same size of clutch ring. The Hill Works are paying special attention to electric lighting work, and are using their best endeavors to meet all the requirements in that line. During the past year they have enjoyed the most gratifying success in this field, and their clutch is used exclusively by a number of the leading parent companies.

Frisbie Friction Clutch Pulleys.—With the increasing demand for electric light, there is also the question "What is the best manner of driving the dynamos?" Friction clutch pulleys

are the most satisfactory, it is claimed, if a good one is used. The dynamo can then be started or stopped at the will of the engineer in charge without stopping or slacking the engine. The matter of running a pulley loose on the shaft is also important. Both of the above points are successfully dealt with by D. Frisbie & Co., of 112 Liberty street, New York. Their pulley has a graphite bushing with which no oil is used. They have had perfect success. They have, within a month, completed a large plant at Utica, N. Y., where they have twenty 50-inch by 10-inch clutch pulleys driving direct to the dynamos from line shaft running 288 revolutions per minute and four 60-inch by 24-inch main drivers at the same speed. Thus any one of the four lines can be run, and any one, or all, of the dynamos can be run. This is considered by all to be one of the best pulleys for the electric light business.

The Taper-Sleeve Pulley Works, of Erie, Pa., report a very large business in their taper-sleeve wooden pulleys and friction clutch pulleys. Their wooden pulleys are particularly adapted for electric light machinery on account of their lightness, perfect balance and greater grip of the belt. Among recent customers for the products of the works are the Fort Wayne Jenney Company, the American Electric Manufacturing Company, the Mather Electric Company, the Van Depoele Electric Manufacturing Company, and local companies in New Haven, Boston, New York, Troy, Augusta, Ga.; Denver, Col.; State College, Pa; Memphis, Tenn.; Fairfield, Me.; Charleston, S. C.; Matteawan, N. Y.; Elmira, N. Y.; Lexington, Ky.; Little Rock, Ark., and many others. The pulley part of the friction clutch pulleys being made of wood, they are much lighter on the shaft and allow the use of slacker belts, transmitting in some instances, it is claimed, 50 per cent. more power than iron pulleys. They are in use doing 250 h. p., and in some instances running at a speed of as high as 700 revolutions per minute.

James Hunter & Son, North Adams, Mass., believe with reason that their patent friction clutch pulley and friction clutch cut-off coupling will be found extremely useful where dynamos are driven from lines of shafting direct, as the pulley is so constructed that when the clutch is disengaged all the friction devices remain at rest with the pulley on the shaft. As recently improved, the Hunter clutch has two sets of tightening screws and levers, which makes the design more symmetrical and the clutch more powerful and better balanced. In the month of August, 1887, the firm placed one of their friction couplings in the mill of the Dwight Manufacturing Company, at Chicopee, Mass. It was fitted to an 8-inch shaft which revolved at a speed of 116 revolutions per minute, and was guaranteed to transmit 1,000 horsepower. This coupling is used to connect and disconnect the steam power and water wheel without stopping the mill or lowering the speed. It is probably the largest and most powerful friction clutch cut-off coupling ever manufactured in this country, and is doing its work to the entire satisfaction of the mill company.

BELTING.

A. B. Laurence.—It is now some sixteen months since Mr. A. B. Laurence, of 82 John street, assumed control for the States of New York and New Jersey, of the Underwood cotton-leather belting, for which he has the exclusive agency. His success in handling this belting has been well marked. The belt runs perfectly true and straight, clings close to the pulley, and is especially adapted to rapid-running machinery on account of its lightness, flexibility, etc. It is practically without stretch, and comparatively noiseless.

Vulcanized Rubber Belting.—The desirability of the vulcanized rubber belting, manufactured by the N. Y. Belting and Packing Company, N. Y., for use in all lines of manufacture, is becoming more apparent daily. This company, who are the oldest and largest manufacturers of vulcanized rubber goods for mechanical purposes in the United States, have lately placed upon the market a superior quality of belting, with smooth metallic surface, for electric light purposes. The adhesive properties of this belting enable it to cling closely to the pulley or wheel on which it is used, which prevents slipping. It is especially adapted for use on dynamos and other swift-running machinery.

The Shultz Belting Company, of St. Louis, furnished during the month of January "electric" belts to thirty different lighting plants in this country. The belting of this company is tanned on the outside or surface only. The interior fibre is rawhide, softened and made pliable by a patent process, affording the advantages of both rawhide and tanned leather. The softness of the grain causes it to adhere to the pulley, and this, together with its great strength and durability, gives it a wonderful driving power, and prevents loss of motion. Its softness and pliability render it particularly adapted to the requirements of small pulleys running at a high rate of speed in positions where a twist is unavoidable. Those who have used this and many other beltings, and are, therefore, qualified to speak from experience, say that for hard service and great strain and for main drive belts on engines its wearing qualities are phenomenal.

Schieren Leather Link Belting.—During the past year, Chas. A. Schieren & Co., 78 Cliff street, this city, have been making a specialty of their leather link belting for use on dynamos. They have belted up more than one hundred electric light plants and stations in that period, and have received a large number of testimonials from them. During the month of January they sold leather link belting to fifteen electric light plants for dynamos. Some of the larger orders were from the Edison Company at New Orleans, the Mount Morris Electric Light Company, of New York, the Edison Company, of Birmingham, Ala., and the Cambridge, Mass., Electric Illuminating Company. These belts, the firm say, have a greater grip power and impose less strain upon the dynamo bearings than any other. Among the strong indorsements as to these points is that of President Johnson, of the Edison Electric Light Company.

PACKING, ETC.

Asbestos.—The Chalmers-Spence Company, 419-425 East Eighth street, New York, have added to their large list of asbestos specialties a patent jacket, to be used as a cover for their well-known non-conducting pipe and boiler coverings. This jacket is both water and fire-proof, and provided with their patent lacings. It is something new, and is attracting considerable attention among steam-users.

The Gould Packing Company, of East Cambridge, Mass., have furnished the Brush Company, of Boston, with packing for years, and also have the Edison people for customers. They are meeting with much encouragement in the electric light field, as their packing is well adapted for both high and slow speed engines. The Gould steam and water packing is, in fact, now well-known and popular in the electrical field.

Hine & Robertson, 45 Cortlandt street, N. Y., are pursuing a novel method of inducing electric light companies to try "Eureka" Packing. To every new customer ordering direct from them 15 pounds or more at regular price, 75 cents per pound, they will send a handsome 8-day calendar clock, 12 in. dial, 24 in. high, or a set of brass oilers and tray, 6 pieces, the best made. This is an easy way to secure one of these necessary articles and at same time get a packing indorsed by very many prominent electric light plants.

LUBRICATING OILS AND CUPS.

The Phillips Oil Cups, etc.—W. P. Phillips & Co., Sudbury street, Boston, have been paying special attention to the lubrication of electric light machinery, and are now calling special attention to an improved oiler for dynamos, etc. It is a drop-feed bearing cup, with a neat and reliable valve regulating device. The construction is simple, and, as Mr. Phillips has the most improved tools for manufacturing the cups, he is enabled to offer them at very moderate prices. The firm will be glad to correspond as to cups, lubricators, general brass work, steam users' supplies, etc.

Synovial Oils.—The business of Mr. S. Taussig, 43 River street, Chicago, in synovial oil doubled in the last year, and is still rapidly increasing. The St. Paul Gas Light Company call the oil the best and most economical that they have ever used. The Kingman (Kan.) Electric Light Company write that it is more economical than cheaper oil, and lots of other testimonials run the same way. Mr. Taussig's trade is almost exclusively with electric light plants, whose managers appreciate the point that the oil can, by filtering, be used over and over again without any detriment to its lubricating qualities. A trial is solicited.

TOOLS, ETC.

Jordan & Gottfried, 208 Canal St., N. Y., carry a complete stock of iron and brass machine and wood screws, bolt cap and set screws, taps, dies, files, twist drills, brass and rubber tubing, rod and sheet copper, brass, German silver, steel and iron wire, shafting, tools, etc.

Sebastian, May & Co.'s advertisement, which appears in another column, is worthy the attention of all electricians and electrical companies who are now, or will be, in need of lathes and tools for electrical work. This firm are turning out first-class tools at very low prices, and the fact that they will send from Cincinnati to any part of the country, subject to an examination and trial, any of their lathes, shows their confidence in their superiority. They have earned a reputation second to none for fine workmanship, and their business has grown in a few years to very large proportions. They take pleasure in mailing their catalogue of tools and supplies to any one interested in same.

W. F. & John Barnes Co., Rockford, Ill., are selling a good many machines to electricians and to electric light and power companies. Their business in this line is confined principally to lathes and drills. While the larger manufacturing concerns call for their drills, electrical experimenters and local companies keep up an active demand for their foot-power lathes, which everybody knows to be adapted in a very eminent degree to smaller electrical work. Among the concerns to which the company have sold are the Indianapolis Jenney Company, the Houston (Tex.) Electric Light Company, the Pueblo (Col.) Electric Light and Power Company, the Laramie (Wyo.) Gas Light and Power Company, and the Mobile Electric Light Company. They also receive a good many letters from electricians in foreign countries, where their lathes can be used to advantage.

CONTRACTORS.

The Jarvis Engineering Company, of Boston, Mass., have made so splendid a record in the electric lighting field, that even to refer to it is a work of supererogation. They have long made a specialty of complete steam plants for electric light and power stations, and have fitted up with full equipment no less than 150 of the finest central stations and plants. The excellence and economy of the Jarvis patent furnace have also become familiar to all, and have won the highest endorsements. The company is represented by agencies in all the large cities, and is ready to undertake contracts through them at the shortest notice.

TURBINES, ETC.

The Leffel Water-Wheel.—The value of a turbine or water-wheel is properly estimated by the amount of power delivered with the smallest quantity of water. The Leffel "Old Reliable" water-wheel, manufactured by Jas. Leffel & Co., Springfield, Ohio, has become deservedly popular, in view of its filling the bill in this respect, and because of the many modern improvements which have lately been made in its manufacture. The economy of a good turbine, over the steam engine for furnishing power in running dynamos, is a prominent feature of the modern water-wheel, and is amply attested by their increased adoption, of late years, for this purpose, where water is available.

The Victor Turbine is being extensively used for driving electric plants, and is growing in favor. Among the most recent shipments for that purpose by Stilwell & Bierce Mfg. Co., Dayton, O., are one 30 inch wheel for Arkansas City Electric Company, Arkansas City, Kan.; two 44 inch wheels for Edison Electric Light and Power Company, Sault Ste. Marie, Mich. One pair of 20 inch wheels on *horizontal shaft*, with iron flume, governor, etc., complete for the San Bernardino, Cal., Electric Light and Power Company. An arrangement of these turbines on horizontal shafts especially adapts them for driving dynamos, as all gears are dispensed with, belting direct from wheel shaft. The great capacity of the Victor turbine in a small diameter and consequent high speed, seems to make it very desirable for such uses.

MISCELLANEOUS.

Platinum.—Mr. H. M. Raynor, 25 Bond street, reports that the platinum business has been very far ahead of that of any previous season in the electric light industry.

The New England Pottery Company, 146 Concord street, Boston, report receiving some excellent testimonials as to the quality of their porous cups. One party in Philadelphia writes them: "Your cups are more satisfactory than other makes." The works have been established 34 years, and are still in the front.

Braiding Machinery.—The rapid growth in the demand for insulated wire has given an impetus to the production of braiding machinery, and the New England Butt Company has furnished a large number of machines to wire manufacturers. The company supplies single and double winders and braiders of all kinds for silk, worsted and cotton braid.

The Standard Paint Company, of No. 59 Maiden Lane, New York, and 280 South Water street, Chicago, calls special attention to its "P. & B" paints and compounds for all branches of electrical work. It has strong testimonials from electrical concerns that have used the goods on wires, brass rods in batteries, moldings in damp places, underground ducts, switch-boards, and the like. The compounds are water, acid and alkali proof, and are good preservatives from ill effects of exposure generally.

Waltham Non-Magnetic Watches.—These watches, made by the American Waltham Watch Company, for whom Robbins & Appleton, 5 Bond street, are agents, were first placed on the market about Dec. 15 last, and are the only American watches which are non-magnetizable. The orders from the wholesale watch dealers are far in excess of the present ability to supply movements. These watches have non-magnetic balances, hair spring and escapement, are accurately adjusted, and possess all the fine time-keeping qualities which have given the name such world-wide reputation.

National Feed-Water Heater.—The National Pipe Bending Company, of New Haven, Conn., have placed over 70 heaters during the past year in connection with electric light plants, and in every case they have been satisfactory. Their heaters are now in use in electric light stations from Maine to California. Among those recently sold are a large one of 800 h. p., put in the Edison station at Boston, and another of 800 h. p., now being put in the new Edison station at Grand Rapids, Mich. Two others, of 400 and 500 h. p. respectively, are preparing for two plants and will be shipped next month. One of 100 h. p. has just been shipped to the Pacific coast.

Metal Polish for Electric Light Machinery.—The attention of our readers is called to the Matchless Metal Polish Company's advertisement on page xxiii of Baker's Tripoline. This polish has attained great popularity in a single year. It is a paste like the Matchless polish that this company manufacture, but much stronger and better adapted to machinery and solid work. The fact of its having been adopted by the U. S. ordnance and navy departments, many of the largest railroad companies, and the leading fire departments and water-works companies is sufficient evidence of its merit. Mr. Baker, the manager, informs us that their sales are constantly increasing, and that recently large shipments have been made to England and Australia. Station superintendents and manufacturers of electric machinery should avail themselves of the company's offer and send for a free sample.

Chrome Steel.—The now celebrated chrome steel, manufactured by the Chrome Steel Works, corner of Keap street and Kent avenue, Brooklyn, N. Y., has extended its usefulness to the electrical field of manufacture, and has proved highly desirable as a magnet steel. It is also employed with the most satisfactory results, in the manufacture of indicators and armatures, and as a bar steel for dynamos and generators. One peculiarity of chrome steel is that it cannot be cut by the finest steel saws, drills or chisels made, as it is much harder than such tools can be manufactured.

Warren Thread Works.—Where cotton yarn has been used in covering wire, the yarn being slack-twisted, often made a pulpy, bulky insulated wire. The insulated thread made by the W. Warren Thread Works, Westfield, Mass., being drawn down to a fine size, lays very closely along the wire and makes a small, hard and compact covering, of fully one-third less circumference than that obtained with the old style. The thread is run through oils which soak and dry into the thread, making it a thorough insulator. A wire covered with this thread will withstand chafing, wear, strain and all kinds of weather. The concern are selling to all the large coverers of wire and are opening up an export trade.

Electric Light Poles.—Notwithstanding the general outcry for underground wires, the demand for poles is still steadily maintained. Mr. H. C. Ripley, of East Saginaw, Mich., who has long made a specialty of cedar telegraph, telephone and electric light poles, reports that last year was one of great activity in his line, enabling him to close out a very large stock of poles. It is early yet to tell what the coming season will develop in new construction, but the indications point to a brisk demand, new orders being already on the inflow from all points. Mr. Ripley's stock is made up from his own timber, and will this season be, as usual, most extensive and of the best quality.

The Butler Hard Rubber Company, 33 Mercer street, New York, have a large electrical trade. The demand from local companies is confined almost exclusively to insulating material for their wires, supplied in the form of hard rubber tubing. The principal business is in the line of sheet, rod and tubing, together with a large number of constantly varying specialties required by parent companies. They are constantly favored with large orders from the Thomson-Houston Electric Company, the United States Electric Lighting Company, and others in the lighting field, as well as those in the line of instrument manufacture. The company are ready at all times to undertake the production of any style or kind of hard rubber work.

The Union Porcelain Works, Greenpoint, N. Y., are, it is understood, the only manufacturers in the United States of what is known as hard vitreous porcelain. Their electrical goods are of the same vitreous nature. Others, it is claimed, are more or less open porous bodies, with a soft glaze, which cracks and al-

lows water to be absorbed. Wires cutting or rubbing against such porous insulators become worn and rough, and the wires break, leading to delay, expense and accidents. There was a time—three years ago, Mr. T. C. Smith, of the works, says—when cheap insulators were in general use, but their vogue has gone, and the business in insulators worthy of the name is now steadily on the increase.

Electric Light Woodwork.—The matter of woodwork in electric light installations, especially where incandescent lamp wiring is concerned, receives considerable thought on the part of those in the business, many of whom are not prepared to manufacture for themselves. To meet the wants here arising Mr. C. F. Dunderdale, of 154 La Salle street, Chicago, has arranged to supply special articles of this character, such as molds, branch-joints for moldings, small cut out boxes to match the same, making a neat joint for main and branch wires, rosettes, either plain or fitted with fusible cut-outs, cleats, bridges, ceiling-boards, etc., in all kinds of wood, and of almost every design that is likely to be required in completely concealed wiring. Mr. Dunderdale's services will undoubtedly be highly appreciated by many who require supplies of this character.

The Phœnix Glass Company, 729 Broadway, New York, and 43 Sixth avenue, Pittsburgh, Pa., have certainly produced a line of arc and incandescent globes and shades of rare excellence. This branch has received special attention, though but one of many different departments in their large works. They are in receipt of voluntary testimonials from several electric light companies using their arc globes, specially praising their high quality, and the economy from less liability of breakage, etc. Their line of incandescent globes is very extensive, embracing effects in glass and designs possible only with the electric light. In rich cut glass, etched, decorated and opalescent—as well as the more staple plain opal goods—they have a very large trade, having only recently filled several of the largest orders ever given in this country for prominent buildings and residences—one order requiring 400 dozen globes. An important item is their advantage in shipping from their factory, near Pittsburgh, all Western orders, saving in freight charges and time of delivery. Catalogue and price lists can be had on application, and a full line of samples can be seen either at the Pittsburgh show-rooms, 43 Sixth avenue, or at their New York salesrooms, 729 Broadway.

Trinidad Line Wire, manufactured by the Callender Insulating and Waterproofing Company, is rapidly increasing in popularity. It is a superior article, and meets the demand for all out-door uses.

The Ansonia Brass and Copper Company are meeting with great success in introducing Cowles' patented fire and weather-proof wire. Its thorough insulation and reasonable price attracts the attention of electric light men.

Woodhouse & Rawson, Limited, of London, Eng., have just been awarded a gold medal at the exhibition at Saltaire, Yorkshire, for the excellence of their installation goods and work. They have also received a bronze medal at the Newcastle exhibition for the lighting of the grounds, 80 Scharnweber arc lamps being used for that purpose.

Okonite.—From recent advices received, it appears that the Lord Commissioner of the Admiralty of England, after a trial at Portsmouth, reports that the Okonite insulated wires in use by them have proven eminently satisfactory. The acknowledgment is signed by Hon. Evan Macgregor. The report of the Commissioners relative to the insulated electric wires on the United States Steamer "Atlanta" is extremely favorable to the Okonite Company.

Partrick & Carter, the well-known old firm of 114 South Second street, Philadelphia, Pa., have just issued a new catalogue and price list for 1888. It fills nearly 70 pages and is a complete guide to the best goods in the various lines handled—such as electric bells, annunciators, fire alarms, push buttons, door pulls, bronze pushes, door and window springs, batteries, electric gas lighting apparatus, electric matting, insulated wires and supplies generally for the telegraph, telephone and electric light field. The list of hotels fitted up with annunciators by the firm fills several pages—a sufficient indication of the excellence and thoroughness of their work.

Standard Test Instruments.—The Electric Manufacturing Company, 311 River street, Troy, are about to issue their new catalogue. They report themselves as behind their orders on their test instrument work, and find that the deeply-rooted prejudice in favor of imported instruments is gradually giving way. They are now, in fact, selling to most of the leading colleges and companies. The only non-electrical appliances they are making at present, used in electric lighting plants, are their speed indicators, in the details of which they have recently introduced some improvements. The company have now got out plans for their new brick laboratory. It will be free from all disturbing influences, and the test rooms will be provided with automatic heat-regulating devices for maintaining uniform temperature.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

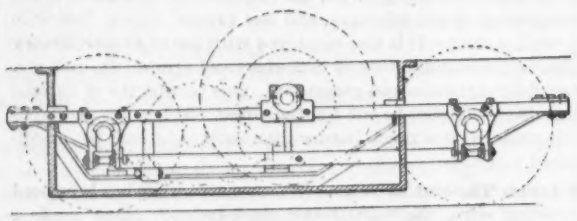
PATENTS DATED FEBRUARY 7, 1888

(1) 377,374. Telegraphy; (2) 377,518. Magnetic Separator; T. A. Edison, Menlo Park, N. J. (1) Assigned to Western Union Telegraph Company, of New York. Applications filed respectively, May 14, 1877, and July 6, 1887. (1) A circuit-preserving and reversing key, a vibrating circuit-breaker and a short-circuiting key at the transmitting station; a polarized relay and a reed and sounder at the other station. (2) Magnetic materials are separated from the non-magnetic by allowing the mass to fall through a closed chamber in front of the poles of a magnet. The magnetic material will be deflected from its course. See illustration.

377,384. Electro-Magnetic Grain Weighing Scale; W. A. Holley and W. Mahn, Holland, Mich. Application filed May 4, 1887. A hopper is provided with suitable discharge valves which are connected in circuit with contacts on the scale beam. When the proper weight of grain is in the hopper the circuit is completed by the beam and the discharge valves opened.

377,397. Electric Railway; W. I. Ludlow, Cleveland, O. Application filed May 16, 1887. The ordinary T-rail is split longitudinally, and the electric conductors carried between the parts. The collector passes down into the slit and makes contact with the conductors therein. See illustration.

377,413. Electrical Apparatus for Effecting Mechanical Movements; R. T. Smith, Nashua, N. H.



377,622. ELECTRIC MOTOR CAR.

Application filed Sept. 17, 1885. It is the purpose of this invention to provide means whereby movement may be given to a mechanical element or device by the make and break of a circuit, the movement being automatically produced at a predetermined time.

377,441. Transfer Switch and Circuit for Telephone Exchanges; C. E. Scribner, Chicago, Ill., Assignor to the Western Electric Co., same place. Application filed July 11, 1885. To prevent leaving any subscriber's line open when connections are made over trunk lines between different boards, spring jack switches and circuits are used, by means of which the grounds are removed when two lines are connected together through any given transfer line.

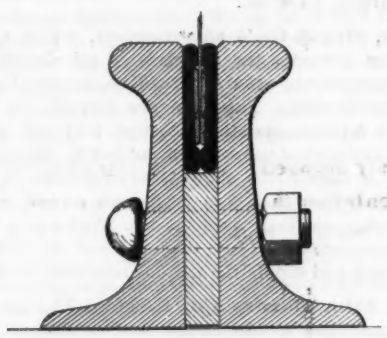
377,475. Telephone Transmitter; J. F. Bahr, Jersey City, N. J. Application filed March 28, 1887. A box is divided into two compartments by a partition of resonant material. To this partition is attached a plate forming one terminal of the line circuit. The other terminal is connected with another plate which rests upon the former and is adapted to vibrate thereon when the partition vibrates.

377,487. Process of Electrolyzing Copper; E. S. Hayden, Waterbury, Conn. Application filed March 26, 1887. The metal plates to be treated are first rolled and then each one is placed in a bath between a cathode and an anode plate without any connection between any of the plates except through the solution. The plates are then subjected to the action of a current of electricity.

377,488. System of Electrical Distribution; J. W. Howell, New Brunswick, N. J. Application filed July 14, 1886. A differentially wound indicating instrument having its coils divided between the indicating conductor of two feeding circuits. The indicating conductor extending from the outer to the inner terminals of the conductors of the two feeding circuits, is utilized to lessen the number of indicators used in the Edison system of distribution.

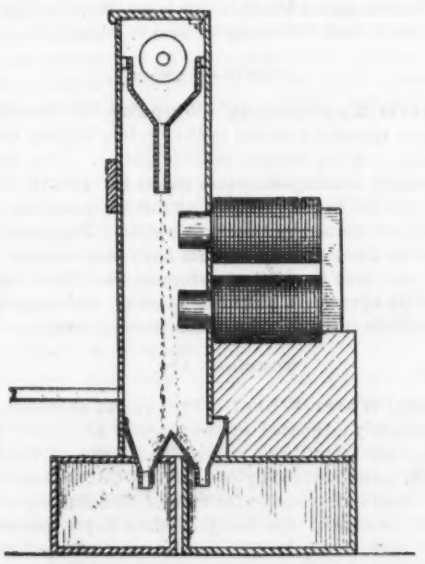
377,505. Electric Gas Lighting Burner; L. S. White, of Waterbury, Conn., Assignor to the Electrical Appliance Manufacturing Company, of same place. Application filed Sept. 20, 1887. The closing of one circuit opens the gas valve, locks it and produces a spark. Another circuit is utilized to release and close the valve. The armature which opens the valve is given a vertical and a horizontal motion. For illustrated description see THE ELECTRICAL WORLD, Nov. 5, 1887.

(1) 377,538. Electric Circuit-Closer; (2) 377,539. Electric Bell; (1) W. F. Stocker, Eureka, Kan., Assignor to W. H. Byers, of same place. Application filed Feb. 2, 1887. This circuit-



377,397. ELECTRIC RAILWAY.

closer consists of a handle divided longitudinally into three spring strips of non-conducting material. Each strip is connected with a metallic plate, which is adapted to close a circuit, when pressure is put upon the handle. (2). The bell consists of a hammer, one or more electro-magnetic armatures, and one or more helices adapted to receive within their coils the electro-mag-



377,518. MAGNETIC SEPARATOR.

netic armatures, either the armature or the helices being carried by the bell hammer lever.

377,553. Electric Gas Lighter; J. Finck, San Francisco, Cal. Application filed Aug. 24, 1887. This is a device which may be attached to the ordinary gas-burner without making any material change. It consists of a frame carrying the sparking devices, having means for ready attachment to the burner, and formed with a collar, which fits over the burner. See illustration.

377,612. Telephone Transmitter; H. V. Hayes, Cambridge, Mass. Application filed Sept. 5, 1887. Two independent chambers filled with powdered carbon and serving as current varying organisms are mounted on springs. They are placed on each side of an arm which receives the vibrations of the diaphragm. Each vibration consequently causes simultaneously a decrease of resistance in one of the current varying organisms and an increase in the other. The object of the invention is improved efficiency by using to the fullest extent the variations of resistance produced by the movements of the transmitter.

377,615. Electric Arc Lamp; E. E. Higgins and J. James, of St. Johnsbury, Vt., Assignors to the Standard Electric Company, of Vermont. Application filed March 24, 1887. The invention consists of a spring connected with the outer case and core of the main solenoid and with one end of a rocking bar, the other end of which is connected with a shunt-magnet. The clutch is connected with a rocking bar and by springs with the base plate of the lamp, a spring trip being used in combination therewith to loosen the clutch.

377,622. Electric Motor Car; W. H. Knight, New York, N. Y. Application filed May 6, 1887. The motor is inclosed in a casing of non-resonant material and the motor frame is connected with the car frame by flexible connections. This construction is designed to lessen the noise and jar. See illustration.

377,626. Electro-Mechanical Signal Apparatus; W. W. Le Grande, Louisville, Ky., Assignor to the Le Grande Signal and Electrical Company, of same place. Application filed July 21, 1887. This is an improvement on patent No. 352,903 and consists in changes in the mechanism whereby a horizontal arrangement and adjustment of a reciprocating pull-bar carriage carrying the first series of pull-bars is constructed to be thrown into engagement with the second series of semaphore

377,553. ELECTRIC GAS LIGHTER.

pull-bars by mechanism electrically controlled and operated in connection with the single switch lever. Other improvements are also described.

377,634. Railway Signal; T. S. Nicholson, Mount Washington, O. Application filed Dec. 4, 1885. A double relay, the armature of which is alternately attracted by two different magnets operated by two different local circuits, and a battery to form alternately a part of two different main circuits. The relay is connected so that the magnets on one side of the relay are always stronger than those on the other side.

377,642. Secondary Battery; J. S. Sellon, Hatton Gardens, County of Middlesex, England, Assignor to the Electrical Accumulator Company, of New York. Application filed April 19, 1887. The plates have a series of insulating plugs extending through and projecting from both surfaces. They are all bound together by rubber bands.

(1) 377,683. Armature; (2) 377,684 Electro-Mechanical Movement; R. H. Mather, Windsor, Conn. Applications filed respectively Jan. 16 and May 3, 1886. (1). A cylindrical armature drum of non-magnetic and insulating material open at one end and traversed longitudinally by conductors which pass circumferentially from side to side of the drum. A stationary core is contained in the drum and mounted upon the same shaft. (2) An armature pivoted between the pole pieces of a magnet has attached to it a spring and a metallic insulated slip, which is adapted to make contact with either of two contact points, according as the magnet or the spring is the stronger. The contacts, strip and magnet are connected up with a motor in such a manner that when the strip is on one contact the motor revolves in one direction and when on the other contact it revolves in the opposite direction.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had from this office for 25 cents. Give the date and number of patent desired, and address Johnston's Patent Agency, Potter Building, New York.